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THE AMERICAN BREEDERS' MAGAZINE

A JOURNAL OF GENETICS AND EUGENICS

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THE AMERICAN BREEDERS MAGAZINE

"My people are destroyed through lack of knowledge."—Hosea 4: 6.

Vol. IV First Quarter, 1913 No. 1

THOMAS ANDREW KNIGHT, 1759-1838

The passing of sterling qualities, straight through four generations of a family is in itself a circumstance worthy of notice, but when this is coupled with the fact, that this transmission culminated in a man who plainly was a genius, this bit of genealogy assumes decided interest.

The great-grandfather of Thomas Andrew Knight, Richard Knight, was according to the traditions of the family a wealthy man. The grandfather, also named Richard, was very wealthy as judged by financial standards of his day; he was an industrialist and iron merchant and was the founder of the family fortune. The father was a wealthy man's son, and so was Thomas Andrew Knight himself.

Thomas Andrew Knight was the youngest of a childship of four, there being one brother and two sisters. It seems that the early schooling of both of these boys had been greatly neglected, but they had inherited fine minds which stood them in good stead. As a boy he learned rapidly; possessing an almost phonographic memory; the quotation of a single line of certain of the classics would elicit from him the recitation of pages upon pages. He was exceedingly fond of out-door life with its exercises, its sport and especially its unlimited opportunities for observation and research. This, coupled with his love for agriculture defined for him his field of work, then unexplored territory, and recognizing no boundaries, he gave free rein to his talents.

The elder brother, Payne, despite his disadvantages in education, developed into a scholar, art critic, collector and writer, and was a member of Parliament for twenty-six years.

Thomas Andrew Knight married Miss Frances Felton with whom he led a most affectionate married life. He settled at Elton, purchased a farm, equipped and stocked it and then threw himself into the study of horticulture and of biological problems, especially vegetable physiology.

Thomas Andrew Knight

Animal life also received his attention; he was especially fond of studying animal behavior and in his extensive farming operations he naturally entered upon the breeding of live stock. He owned and bred with much skill and judgment a herd of Herefordshires, successfully showing at Smithfield and Hereford and earning many prizes. It is interesting in this connection to note that the researches he made into the cause of the superiority of the Hereford, led him to attribute this quality to the introduction of a breed of cattle from Flanders, by Lord Scudamore whose death took place 1621. A Merino ram presented to him by George III was the foundation of a breed made by crossing with the Ryeland breed of sheep. This flock Knight bred for a number of years. He is also credited with having made an importation of Norway ponies, probably Fjord horses, intending to add some of the qualities to the stock of English work horses.

Although most of his scientific work was far in advance of his time, he combined this with an unusual degree of practical sense. He never lost himself in speculations. Utility and practical end results were ever kept in sight in all his numerous and varied investigations. He worked out much of what we know of the theory of horticulture.

In 1797 he took active part in the organization of an agricultural society of Herefordshire. In 1802, a commissioner sent by the Czar of Russia to England, to procure for breeding purpose some pure blooded cattle and sheep for the imperial estates, delegated Mr. Knight to make the selections and purchases from the famous herds of England.

Knight's contributions to plant breeding were important. He was, so far as history notes, the first person to cross pollenate the flower of the apple for the purpose of creating new varieties through new combinations of characters. He placed in the hands of the English fruit growers many of their best varieties. From the application of his newly discovered method of combining desirable qualities by crossing of apples, it was a logical step to breeding vegetables and flowers. In the search for laws underlying the transmission of certain characters which he observed, it was not a mere coincidence that he, as did Mendel many years after, chose the common garden pea for experimentation. In a paper on the "Supposed Influence of the Pollen in Cross Breeding upon the Color of the Seed Coats of Plants and Qualities of Their Fruits," read before the Horticultural Society in 1823, a year after Mendel was born, he gives this reason for using the pea:

The numerous varieties of strictly permanent habits of the pea, its annual life, and the distinct character in form, size, and color of many of its varieties, induced me, many years ago, to select it for the purpose of ascertaining, by a long course of experiments, the effects of introducing the pollen of one variety into the prepared blossoms of another. My chief object in these experiments was to obtain such information as would enable me to calculate the probable effects of similar operations upon other species of plants; and I believe it would not be easy to suggest an experiment of cross breeding upon this plant, of which I have not seen the result, through many successive generations. . . . . I shall, therefore, proceed to give a concise account of some of these experiments, or rather to state the results of a few of them, believing that I shall be able to explain satisfactorily the cause of a colored variety of the pea having been apparently changed into a white variety by the immediate influence of the pollen in the experiment of Mr. Goss.

Other papers he contributed were: "On the Comparative Influence of Male and Female Parents on Their Offspring;" "On the Hereditary Instinctive Propensities of Animals."

Mr. Knight lived a rather retired life, being almost shy of people, except when he met with minds similar to his own and engaged in similar work. He had friends among the most noted scientific men in Europe and with them carried on a voluminous correspondence. He was elected Fellow of the Royal Society in 1805.

A STUDY IN EUGENIC GENEALOGY.[a]

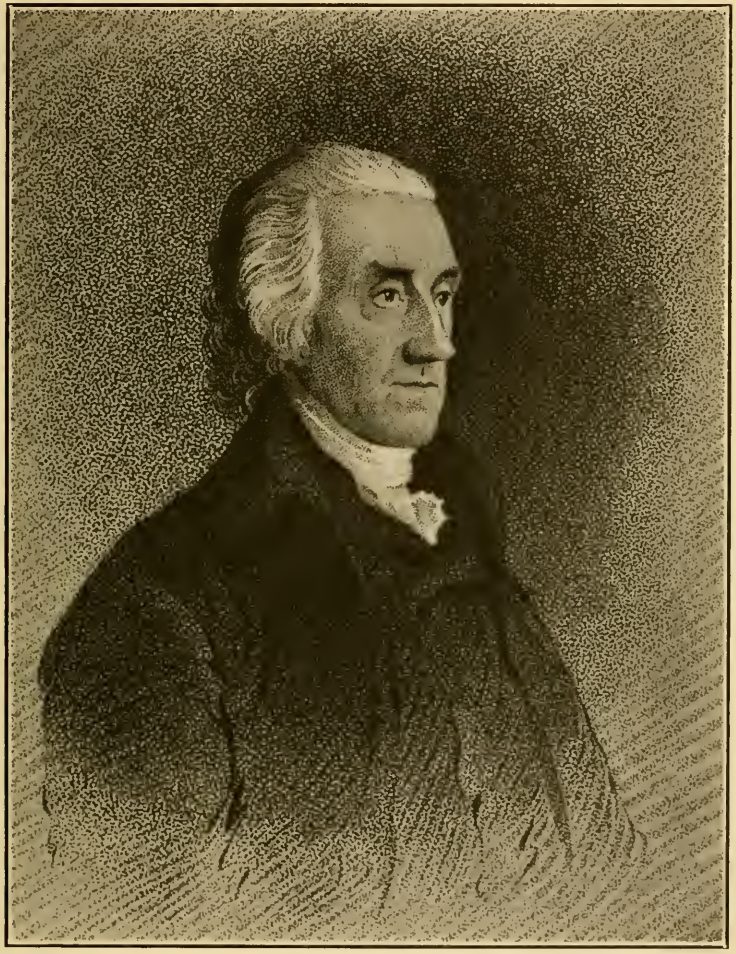
A. GARTLEY
Honolulu, Hawaii

Two other of the descendents of Elizabeth Tuttle, through her son Timothy, have been purposely omitted from the foregoing catalogue since they belong in a class by themselves, because they inherited also the defects of Elizabeth's character. These two were Pierpont Edwards, who is said to have been a tall, brilliant, acute jurist, eccentric and licentious; and Aaron Burr, Vice-President of the United States in whom flowed the good and evil of Elizabeth Tuttle's blood. Here the lack of control of the sex impulse in the germ plasm of this wonderful woman has reappeared with imagination and other talents in certain of her descendants.

The remarkable qualities of Elizabeth Tuttle were in the germ plasm of her four daughters also: Abigail Stoughton; Elizabeth Deming; Ann Richardson, and Mable Bigelow. All of these had distinguished descendants, of whom only a few can be mentioned here. Robert Treat Paine, signer of the Declaration of Independence, descended from Abigail; the Fairbanks brothers, manufacturers of scales and hardware, and the Marchioness of Donigal, were

[a] Continued from vol. III, no. 4.

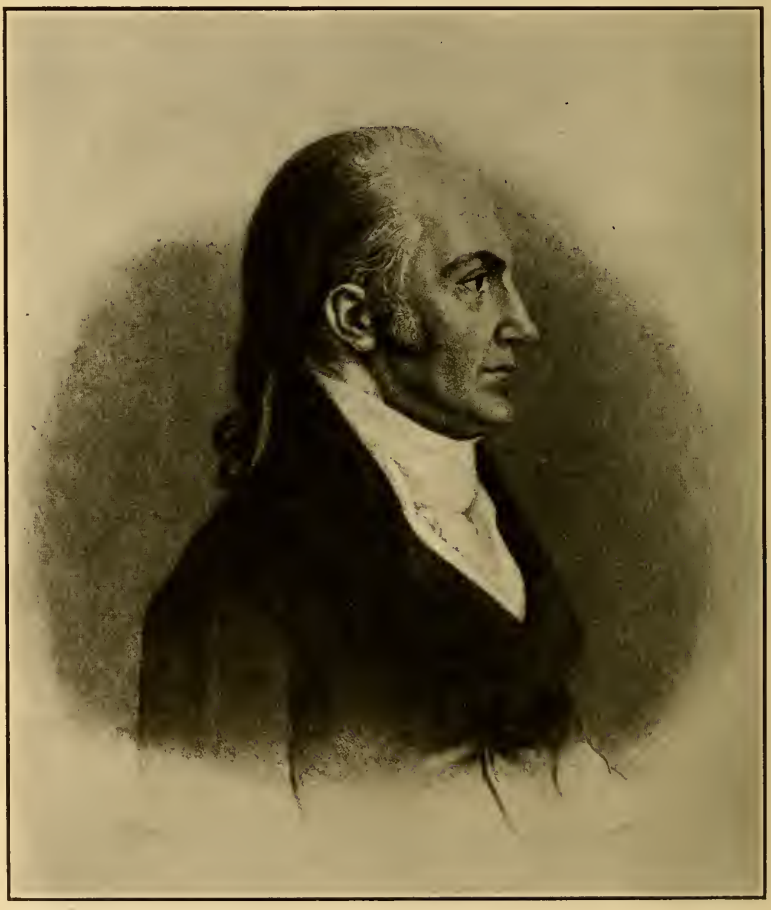
descended from Elizabeth Deming; from Mable Bigelow came Morrison R. Waite, Chief-Justice of the United States, and the law author Melville M. Bigelow; from Ann Richardson proceeded Marvin Richardson Vincent, professor of sacred literature at Columbia University; the Marchioness of Apes-



ROBERT TREAT PAINE

tiguia of Cuba, and Ulysses S. Grant and Grover Cleveland, Presidents of the United States. Thus two presidents, the wife of a third, and a vice-president trace back their origin to the germ plasm from which (in part) Elizabeth Tuttle was also derived, but of which it must never be forgotten, she was not the author. Nevertheless, had Elizabeth Tuttle not been, this nation would not occupy the position in culture and learning that it now does.

Furthering of the productivity of the fit must come through education in the subject of heredity and the encouragement and promotion of a public sentiment favorable to the determination and recording of the value of each individual as a progenitor of healthy



AARON BURR

generations and the racial breeding value of each family and strain. This knowledge at hand the normal person can with perhaps a word of advice from a trained eugenist, choose a mate and produce only normal children.

A word concerning the checking of the birth-rate of the unfit. The establishing and recording of potentially weak strains will result

in genetic ostracism which will reduce their fecundity, while strains marked by dangerous defects and by anti-social traits must be rendered harmless by isolation or when necessary, by sterilization.

The problem is not a monumental one, for the anti-social unfit amount to but 2 or 3 per cent of the population. This comparatively small percentage brings us into intimate contact with crime, degeneracy and disease so seldom that we have become accustomed to ignore it or accept it as a necessary evil until our sympathies and indignation are as deeply aroused as they were recently when Judge Whitney presented but a few of the pitiful cases he has met in his admirable and humane social uplift work. Then we are so filled with sympathy and good intentions that we choke as we ask, "What can we do?" Many measures of relief are only temporary and David Starr Jordan has said "Charity creates the misery she tries to relieve; she never relieves half the misery she creates."

This 2 or 3 per cent of delinquents, deficients, and dependents bring us more unhappiness and misery and are a greater drain on society than their numbers would warrant. All our criminal law and the huge machinery of its execution and our costly institutions for correction and detention are for their benefit and are heavy drains on our energies, finances, and sympathies. We inquire, "Were it not better they should not have been born?" Our civilization tenders them such fostering care and has placed so few restrictive measures on their reproduction that it is breeding the race downward, and we are confronted by the appalling fact that the fecundity of the unfit is vastly greater than the normal average and that they are increasing, notwithstanding they perish in great numbers due to the lack of proper nuture. Furthermore, our present social standards tend to sterilize our strong and desirable strains and reduce their fecundity below the average. The principle of the survival of the fittest no longer applies, for we are rendering no aid to the fit and are carefully fostering and promoting the survival of the unfit. True, our criminal laws are made to prosecute and destroy many who are sick in body, mind and morals. England, for instance, no longer lops them off in such great numbers as she did a century or so ago when she had 215 capital offenses on her statute book.

What result to our national welfare may be expected? Is it not time that we strike at the root instead of lopping off the branches? We have with us in Honolulu all known social and economic problems, somewhat intensified perhaps, by our insularity and our mixed population. It is therefore necessary that we intelligently apply every

known means of increasing our social welfare. Attention should be directed immediately to the problem of our so-called non-leprous children and the application of eugenic principles to the admission of incoming aliens.

ULYSSES S. GRANT

One of the rights of a state is to exclude mentally, morally, physically, and economically undesirable aliens, and although our United States laws are long and formidable they have not succeeded in excluding a defective and degenerate element and the eugenically unfit. During some periods the administration of the law has been lax and inadequate and ineffective measures of enforcement have greatly added to our already too large numbers of insane, feeble-minded, degenerates and those afflicted with or prone to contract

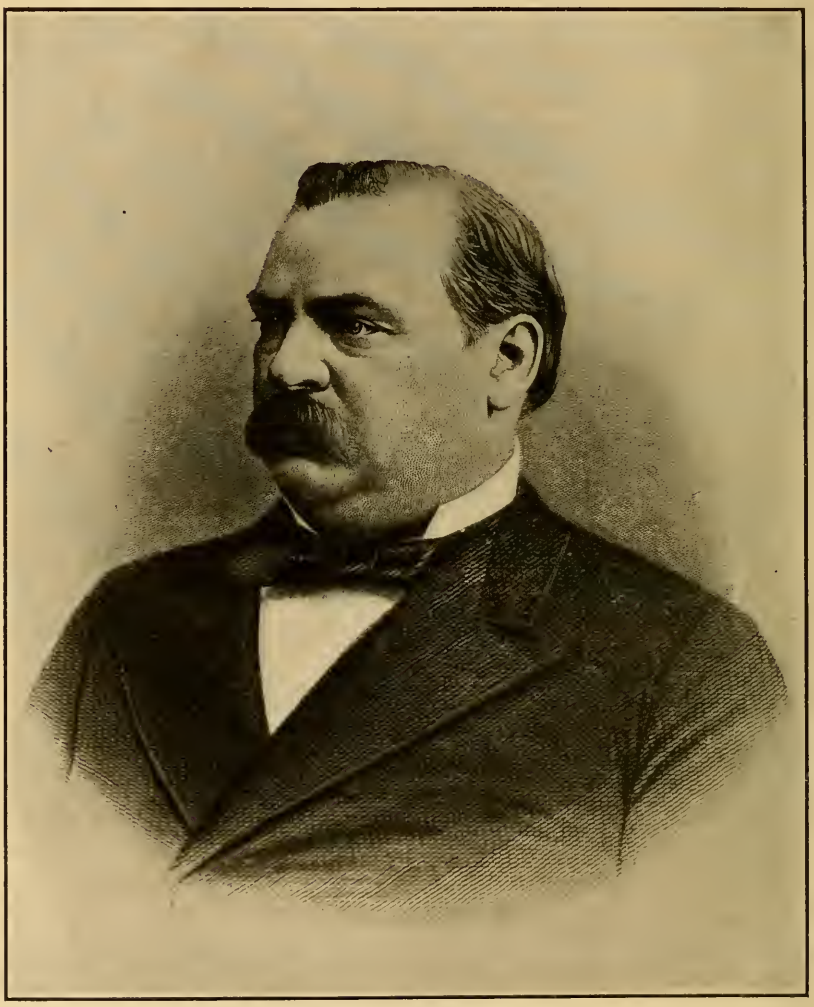
dangerous, contagious and loathesome diseases. We have left the choice of the alien, and the shaping of the laws admitting him, too much in the hands of purely commercial interests. Steamship companies reap their benefits from, and are therefore interested in, the numbers that can be induced to travel on their vessels, and the pitifully inadequate fine imposed for bringing in the unfit alien is insured by a deposit made by the alien himself.

The law itself which excludes persons "who are found to be and are certified by the examining surgeon as being mentally or physically defective, such mental or physical defect being of a nature which may affect the ability of such alien to earn a living" has been rendered partially ineffective by being construed as an economic test rather than a physical one and accordingly the filing of bonds has admitted many an alien of poor physique, low vitality, non-resistant to disease and the potential parent of weak and dependent children. We appoint and maintain agents and inspectors to investigate and prohibit the importation of defective or infected cattle and encourage the admission of the better strains. Should we not exercise equal care in admitting human beings? The duty of those in charge of our ports of immigration is clear.

I have only outlined a bare skeleton of the many principles of this new science and already my paper is too long. I cannot forego a prediction as to the place the science of eugenics will occupy. Each generation or century produced results proportional to the concentration and application of its great minds, be it in scientific achievements, arts, literature, or religion. In the latter half of the past century the concentration on the sciences has resulted in physical achievements and an accumulation of knowledge and social responsibilities far in excess of the total of all previous centuries. This generation has advanced far ahead of the normal standard of society of previous generations and the individual of each succeeding generation finds himself surrounded by a mass of ever-increasing knowledge and responsibility, in excess of his capacity, and he longs for the simple life. It is evident a social readjustment is necessary. If the normal human capacity can be increased each generation by ever so narrow a margin and desirable determiners introduced, making education and moral and religious instruction more valuable, or less necessary, a complete social adjustment will be possible and permanent progress be made.

During this century the concentrated effort of our greatest minds, will be directed to the development of our race, and eugenics, social

adjustment, and education will coöperatively produce results which will transcend any produced by the uncontrolled evolution of the past 60 centuries. It is the duty of every thinking citizen interested in social welfare and advancement to keep pace with the advancing



GROVER CLEVELAND

eugenic knowledge, and keep in mind the following last paragraphs of Galton's Memoirs as these are a summing up of a lifetime of study and experience in eugenics.

Charity refers to the individual; statemanship to the nation; eugenics cares for both.

It is known that a considerable part of the huge stream of British charity furthers by indirect and unsuspected ways the production of the unfit; it is more desirable that money and other attention bestowed on harmful forms of charity should be diverted to the production and well-being of the fit. For clearness of explanation we may divide newly married couples into three classes, with respect to the probable civic worth of their offspring. There would be a small class of desirables. It would clearly be advantageous if social and moral support, as well as timely material help were extended to the desirables and not monopolized as it is now apt to be, by the undesirables.

I take eugenics very seriously feeling that its principles ought to become one of the dominant motives in a civilized nation, much as if they were one of its religious tenets. I have often expressed myself in this sense and will conclude the book by briefly reiterating my views.

Individuals appear to be as partial detachments from the infinite ocean of Being, and this world as a stage on which evolution takes place, principally hitherto by means of natural selection, which achieves the good of the whole with scant regard to that of the individual.

Man is gifted with pity and other kindly feelings. He has also the power of preventing many kinds of sufferings. I conceive it to fall well within his province to replace natural selection by other processes that are more merciful and not less effective.

This is precisely the aim of eugenics. Its first object is to check the birth rate of the unfit instead of allowing them to come into being though doomed in large numbers to perish prematurely. The second object is the improvement of the race by furthering the productivity of the fit by early marriages and healthful rearing of their children. Natural selection rests upon excessive production and wholesale destruction; eugenics on bringing no more individuals into the world than can be properly cared for, and those only of the best stock.

THE FARM, THE HOME OF THE RACE[a]

W. M. HAYS

Washington, D. C.

The Farmers' National Congress is hardly the place for a technical paper. I therefore must apologize for a rather technical introduction to a subject somewhat new to the Congress, that I may discuss briefly one of the broadest general questions connected with the open country and with our national life.

In presenting this subject I come primarily as the representative of the American Breeders Association and only incidentally from the National Department of Agriculture. My theme deals with a subject that is parallel in importance with our greatest economic problem, the fertility of the soil. The laws governing the breeding of plants and animals, when applied to the betterment of the inherent or

[a] Address delivered before the Farmers' National Congress at its annual meeting at New Orleans; Louisiana, November 7, 1912.

genetic agencies which largely determine human efficiency, rectitude, and happiness, are only beginning to receive attention. Scientists are only beginning to have large faith in the application of the laws of heredity to the human family. Our educators and preachers are only commencing to think how much easier their tasks will be when all people inherit only normal and efficient qualities. Our philanthropists are only beginning to realize that we are allowing the weak to be born, and then supporting them in their incompetence, disease and crime. Our statesmen are only beginning to see that part of the public money and effort expended on almshouses, homes for feeble-minded, insane asylums, prisons and other eleemosynary institutions would better be devoted to a study of human heredity and the formulation of such policies as would lead to a smaller number of births among defectives.

Statistics tell us that we expend more than 10 per cent of our productive income on those weaknesses, vice, and diseases which depend in large part on defective heredity. And along with this loss of wealth is suffering, grief and despair of a character and amount not known even in war. Surely a small percentage of this vast expenditure should be spent in studying heredity, which is the basis of our bodies and of our very souls. Manifestly the triumvirate, education, religion and eugenics, must coöperate in building up a greater race.

The open country has two main functions: The production of raw products of food and clothing for the whole people; and the support of farm folks in such a substantial way as to induce the best of them to permanently live on the land and to have healthy and large families, that their virile blood may dominate the whole race. The food problem is the immediate one, but even at the risk of being called visionary I shall briefly outline why the genetically efficient people should be especially encouraged to rapidly multiply, that they may gradually take the place of the less efficient stocks.

The American Breeders Association, through its Eugenics Section, so far holds the attitude mainly of investigator rather than that of teacher. Its efforts have been expended to find the facts, to avoid quackery in eugenics and to discover what the limitations of the field of human breeding are, and wherein lie its practical phases. To bring this subject to a scientific status it is organizing a force of technically trained investigators. Already twenty persons are continuously employed in recording the genetic characteristics of families. The several thousand families already studied represent those

human stocks in which hereditary mental defects occur, but normal and unusually brilliant families are also included.

Thousands of experiments have verified the cross breeding experiments from which were deducted the laws of Mendel. Most of the newer facts concerning heredity have been wrought out through experiments with plants and animals. But sufficient studies have been made in human heredity to show that the laws which apply to heredity in these lower forms apply in practically the same way in the human family. Mendel has thus led us into a formal and mathematical way of looking at the elements which go to make up the heredity of an individual or of a race. Blue eyes or brown eyes; light hair or dark hair; tallness or shortness; a Roman nose or a straight nose; ability in music or the lack of such ability; ease in learning mathematics or dullness in mathematics; a cheerful disposition or a sober disposition; lack of resistance to tuberculosis or immunity to this disease; and a thousand and one other characters act in heredity as units much more definitely than we have generally believed.

There seems to be a heredity carrier in the generative cell for each unit character. These carriers have great power to keep themselves intact, whether the unit be the blue eyes, the Roman nose, the cheerful disposition or other characteristics which plunge through successive generative cells and come up dominant or are dormant in a given generation. How those carriers which appear to be absent or remain dormant during one or more generations, may again be given expression in a future generation with power to come up as an unmodified unit, is the marvel of heredity. Thus in the union of parents with similar unit characters, as well as in the union of parents somewhat dissimilar, and also in the union of parents radically dissimilar, we find these unit characters operating much as the fibers woven together into a fabric in the loom with much system in the weaving of the fabric.

Modern genetic science, based on the work of Mendel and other investigators, centers eugenics science, or the breeding of races of men, about unit characters.

It is not strange that this new science gives man vastly more power in the breeding of plants and in the breeding of animals than in the improvement of his own race. It is not strange that the practice of eugenics is restricted to very narrow limits indeed. The long life of the individual, only one child at a birth, relatively few children, and various social customs, considerably restrict those radical

selective processes such as may be practiced in the improvement of the heredity of plants, or even of animals.

True, we can hope to eliminate gradually the larger portion of those families which have in their network of descent fibers of feeblemindedness, insanity, or other weaknesses so pronounced as to make the individuals into whose being these unit characters are woven a heavy burden upon society. It is probable that methods even more generally applicable than segregation may be advised for the prevention of child bearing by these least efficient stocks of people. But those who are experienced in plant and animal breeding, realizing the limitations in eugenics clearly recognize that the remnants of these weak fibers will be bred out only with great care and through many generations of common-sense effort. It may be said, though, in passing, that the mere elimination of most of our 4 per cent defective and criminally inclined classes, will alone amply repay for all public and private cost that is likely to be expended.

The fact that in some of the civilized nations nearly ten per cent of the marriages are so unfortunate as to terminate in divorce, would indicate that marriage is entered into with less precaution than formerly and that we are both unscientific and inefficient in our plans of choosing helpmeets. It may be said that genetically not more than 25 per cent of our human matings are as wise as might be if the contracting parties could make their choice with full genetic information.

The philosophy of the old expression of the stockman who sought the proper "nicking" of his animals, has in Mendelism found an explanation. If two feebleminded people marry, all the children will be feebleminded. If two persons from families not resistant to tuberculosis marry, a large percentage of the children will in most cases be more or less predisposed to this disease. If, on the other hand, a normal person in whom there is, in recessive form, some hidden fiber of feeblemindedness is married to a person in whose family there are no feebleminded fibers, the immediate progeny will be normal. In other words, in many cases with full genetic data of both families in hand, the scientifically trained eugenist can give fairly accurate advice as to the probable proportions of defective or normal progeny from a given mating, and thus can advise against matings where the chances are that a part of the children will inherit unfortunate characters. Enough of the theoretical basis is already known to make it sure that science will eventually and very materially help in human matings.

Detailed facts concerning general efficiency values and dominance of unit characters in the heredity of persons, including those characteristics which result in inefficiency, are not as yet available except in case of a very few families. The common folk-talk and personal knowledge at present furnish the only guide to persons who contemplate marriage, and this information is often too meager for judgments which are just to the future generation. If the general efficiency of each individual, and also his or her efficiency or deficiency along any specific line in which there is deviation from the normal, were recorded; and if these records of individual values were so tabulated as to give genetic values and were worked out as is done in breeding such plants as corn or cotton, our knowledge of family values would be fairly accurate and definite. The basic information would be such that in questionable cases careful study could be made by the individual or by some persons trained in genetics that the interested person might select. A case recently came to my notice in which a young couple, desiring to enter upon matrimony, consulted an eugenist concerning their case. The troublesome fact was that the young lady's maternal ancestors for three generations had been seriously afflicted with mental illness at about a given age. Upon the advice of the specialist the young couple agreed to postpone marriage for a year, pending a careful investigation of the heredity of both families.

But the large facts regarding the weaving of the stronger, cleaner, more efficient network of descent for the human family must be approached also from another angle. It is not always true that like begets like nor that the best begets the best; but it is true that the genetic like begets like, and the genetic best begets the best. There are three major phases of the practice of eugenics: First, the elimination of the genetically very inefficient; second, the prevention of matings which may perpetuate weakness in the race; and, third, the production of relatively larger families by the socially and individually efficient, advocacy of relatively smaller families by the less efficient.

If these propositions be true, the open country and the farm home take on a new racial significance beyond anything heretofore considered. We are accustomed to look upon the farming business as both the substantial basis and the balance wheel of our national economic prosperity. We have looked upon the electorate in the open country as the support of every meritorious forward political movement, and at the same time as the great conservative agency

in both social and political questions. We have come to look to the open country as the source of fresh blood with which to keep up the vitality of our city life, as the main conservator of the physical development of the race and of the nation's moral and religious life.

This is in no small part a country life problem. Until recently—historically speaking—nearly all the people of the race lived in the open country. Sixty to ninety per cent of the population were engaged in procuring food and clothing. The heredity of the human family has been wrought out through ages of open country life. During the last two or three generations a great change has taken place. Those civilized nations which are utilizing steam and electrical transportation, have devised wonderfully efficient and complex machinery for production and distribution, and have developed their home making into a science and an art, and only one-fourth to one-third of their populations are engaged in tilling the soil and in making their homes in the open country. Thus we have those people, now rapidly becoming city-dwelling people, whose heredity, or to use a figure of speech, whose network of descent, was woven for life in the open country.

In considering these particular phases of the relations between country and city life, we have been inclined to overlook some of the counter agencies and influences. We have not given due weight to the fact that we have been reducing the fertility of our soils and have decidely depleted our forests by using forest products three times as rapidly as we are growing them, and that our methods of agriculture are such that production has rather fallen behind population. We have overlooked the fact that there is ignorance, inefficiency, and even corruption in part of our rural electorate, second always to the inefficiency and corruption of part of our city electorate. We also too frequently overlook the fact that along with these, the country furnishes also a very great number of mediocre people. It is true that many of the great moral leaders in our centers of population have come from the country; but it is also true that the country supplies not a few of the crafty men and weak women to carry forward the vices of the city.

Finally, we have not fully comprehended and outlined the ultimate possibilities of the open country in its relations to race building. The open country of the United States is just passing from its pioneer period. It still has the one-room school, the divisive church, and some of the other conditions which leave the organization of country life in a county or state in a jumbled-up condition. There are so

many unrelated and diverse neighborhood centers overlapping each other about schools, churches, stores, villages, and other organizations, that strong community life does not exist in the country except in the occasional district. When the new movement to consolidate the rural schools, which has already covered between 5 and 10 per cent (between 2000 and 3000) of our entire territory, has had time to reach its final development over nearly our entire open country; and when for a generation hence we have annually spent some hundreds of millions of dollars on the reconstruction of our public roads, the value of the open country in relation to race improvement will be even more apparent than now.

Already we have two or three thousand consolidated rural schools. Both Ohio and Indiana have consolidated nearly one-third of their former one-room district schools into these splendid country life schools, each has several hundred of them. It seems assured that thirty to forty thousand consolidated rural schools are destined eventually to take the place of two or three hundred thousand one-room schools in the United States.

In thus enlarging the area of the school district from the walking limit, of two miles square, to the team-haul limit of five miles square, public school vans are provided which can also be used to assemble the youth or adults in meetings for other purposes, social, economic, political, or even religious. Since through such realignment all the people of the school district will come to know each other intimately, during their school days, there will be a strong tendency for the church and other community institutions also to center beside the consolidated rural school, whether it is in the village or in the open country. An agricultural county with fifteen compact communities, each containing five to fifteen hundred people all trained to coöperate, will become unified in all kinds of activity. Educational, social, economic, and political purposes can here be accomplished in a democratic way. Leaders will be chosen to express the will of the community and to coöperate with similar leaders representing the other communities of the county, and thus country life leaders will grow up. Thus the interests of the county will be federated to act as a unit with federations in other counties. State organizations will naturally federate the organizations of all the counties, and in turn a great national federation, such as is proposed at the meeting of this Farmers' National Congress, will be the logical result at the top.

The farm and the farm home are the elemental institutions upon which country life organizations must rest. By the mere physical act of consolidating the rural school districts into large districts in which all community activities are centered and unified, the basic action is taken to make country life over. This one feature of reorganizing country life will make it possible to provide the supplemental institutions within reach of the farm home which will give the necessary support, outlook and opportunity to the farm family. In and through the consolidated rural school district, most of the coöperation and help needed from the outside, from the national and State departments and from other institutions and organizations can be supplied to the farm and the farm home.

The consolidation of the rural schools in rural America is a vastly more important and far-reaching proposition than any contemplated changes in our tariff laws. If done properly, and if the full possibilities of country life reorganization are kept in view in these new districts, and if our public roads are improved, as eventually they will be, the family farm will even become vastly more important to the nation than now. Not merely the few best farms, but all farms will become places for people of good heredity who will thus seek to remain on the land as the best places for a large family life. The consolidation of our rural schools is the one great important and paramount country life problem of every rural community and of the nation.

In the county in which I live, Montgomery County, Maryland, beside the District of Columbia, there should be say seventeen consolidated rural school districts, each with a territory about five miles square. This would provide for seventeen teachers of agriculture and seventeen teachers of home economics, or thirty-four technical teachers in all. If, in addition to this, the county superintendent, the assistant county superintendent, a county farmers' bureau expert, and a county farm home expert, besides secretaries of the Y. M. C. A. and Y. W. C. A., were all trained in the manner suggested above we should have in the county a technical force of about forty people. These would not be added workers. They would be a portion of the former teaching force required in the one room schools trained for special work while the whole number of teachers would be reduced. When we look about and see the marvelous results which have come from the relatively few people now at work in our agricultural colleges, experiment stations, and

departments of agriculture, may we not hope for ten or twenty times larger results when the new sciences of agriculture and home economics are brought home to the people of each county by such an organization of people thus trained and experienced?

Under these conditions, where all the farm youth are trained for the management of farm homes, may we not expect that the large estate, which too often means a laboring class of semi-peasant type, shall give way to a group of family farms, owned and worked by the farmer and his family, as is the case in most of our great country?

Those acquainted with life in the open country can best picture for themselves the attractiveness of country life when the farm, the home, and the community are properly organized, equipped, and better supplemented by community organizations. Then will not the security of the country rest doubly safe on an intelligent rural electorate? Then cannot the home, the school, the church, and the young people's Christian associations unite in team work in the building of characters which will assure private and national honor in all things.

The open country is the best home of the race as country and city are now constituted. When the country shall have been built up and developed and the race bettered physically, intellectually, and genetically, the open country will continue to be the best place for the best of the race, that the best may so multiply as to become the whole of the race.

The state and the nation should do more for the open country, but not in a paternalistic way. All help from the outside should be in the nature of coöperation. It should always be given under conditions which will lead to local support and effort. There is grave danger of paralyzing local activities by supplying too much from the outside. But possibly the largest danger is that we shall fail in that happy coöperation between the general and local agencies which will get the needed work done. The development of the open country is a mighty work needing large efforts on the part of all available agencies.

Country life education and organization such as is coming forward is laying foundations to greatly increase the number of excellent farm homes and the number of strongly developed country-young-people. We have done much to produce wealth and to increase economic production, and I believe we are approaching an era in which we shall broadly combine with the production of food, systematic and extensive efforts to build up the farm home and the commu-

nity social life of the open country, and the production of a country people among whom greater efficiency will be based on both superior blood and superior education.

The inefficient and the unfortunate who have neither earning ability nor productive capital, are in a crowd, the pace of which they cannot keep. The free food, clothing, fuel and material for shelter of the past are fast passing into the hands of active, efficient producers, and among those into the hands of a capitalist class. The person today at the bottom of the economic scale has the hardest time ever. Families and portions of people subsisting by charity are becoming impossible as a racial asset. Only efficient people have a place in the new times. Science demands the improvement of the race, both eugenically, and eusthenically, that is both by heredity and by improved environment.

The organization of the open country, the villages and the suburbs into the best places for motherhood and fatherhood, is a great national duty and opportunity.

This Farmers' National Congress has before it a proposition to so amend its constitution as to make of it at once the greatest agricultural society, the greatest country life federation, because we have a remarkable body of farm people. If there were no other reason but the eugenic purpose of thus uniting in one powerful coöperative association all people who believe in farm life, that would be ample cause for making this a highly developed and efficient organization.

And why should not my suggestion of a year ago, in the address introducing the proposed new form of constitution for this Farmers' National Congress, be followed, and the new Country Life Federation join with other like federations of other classes of people. A great American Welfare Federation, uniting in one powerful federation, the national organization of farmers, women, laborers, manufacturers, Y. M. C. A., and Y. W. C. A., workers, genetists, educators, scientists, conservationists, home makers, artists, peace advocates, and altruists generally would learn to express the clearest vision of the best thought of the whole people on the largest and most important problems of our beloved country. Such organization could hold in abeyance the clouds of war, could help bring unity of thought and action concerning the liquor question and its expressed will would be felt in favor of a broader education and a wider spirit of individualism in coöperation.

The spirit of coöperation and unity displayed in the deliberations concerning the making of the Farmers' National Congress a great

national country life federation will commend itself to all the associations, institutions, and departments which the proposed constitution would invite to adhere and be represented by sending delegates to the national federation. The power which these constituent organizations will bring to the federation will prove to be marvelous. Our special and general country life associations, our agricultural colleges, experiment stations, and departments, including our farm women's associations and institutions, will supply trained and seasoned leaders, which in this general organization will find opportunities to help crystallize and put forward the mighty things to be desired by our great farm people.

Nowadays a decade witnesses the culmination of accomplishments larger than were achieved during the entire century recently closed. May it not be that the building up of the open country so as to build up the heredity of the races of man is to be at least one of the achievements of the twentieth century?

Truly the proposed new Country Life Federation has before it more problems than the increasing of the products of the soil. It can help to produce a new civilization based on truly efficient people.

HORSES AND HORSE BREEDING

H. K. Bush-Brown

Washington, D. C.

It is a curious thing that fossil remains of the horse are found on this continent where the race had become extinct ages before its discovery by Columbus. On the other hand the living horse is indigenous to Africa, Europe or Asia, but as to just where, authorities differ greatly.

Whether all horses living are of one family or may be divided into four families or more, is perhaps of little interest to the breeder. He has his own ideas of differentiations as he sees them. No matter how insistently science may claim a common ancestry for the horse no breeder will ever recognize the zoölogical law to such an extent as to try to breed draft horses from Shetland ponies, for instance. If, as some claim, these wide differences of type are largely of man's selective creation, so much the more important it is to study them, if the breeders are to take advantage of variations in creating still other types adapted to the needs of man. In this connection I

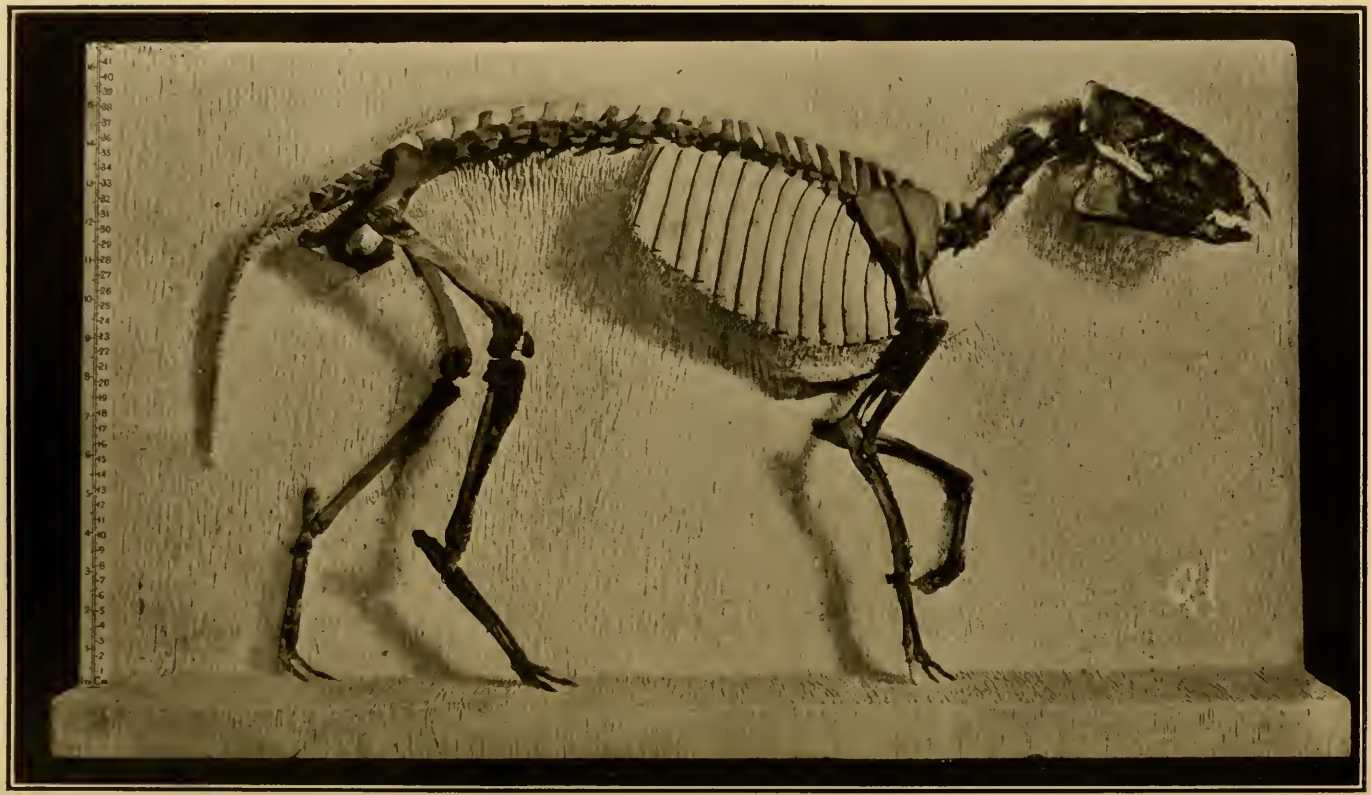


FIG. 1.—OROHIPPUS OSBORNI.
Three-toed horse, Middle Eocene, Wyoming.

would ask for a continued study of anatomical variations that are known to exist, for in the process of evolution of the horse, nature has done and is still doing some interesting things with the bony structure of that animal.

Great was the excitement in the field of science some years ago when Prof. O. C. Marsh of Yale discovered in rock strata on the western ridge of our continent fossil remains of a three-toed and a four-toed horse. If we look carefully at these specimens now in the Museum of Natural History in New York, we will find that the three-toed horse has eight lumbar vertebrae (see Fig. 1); the early

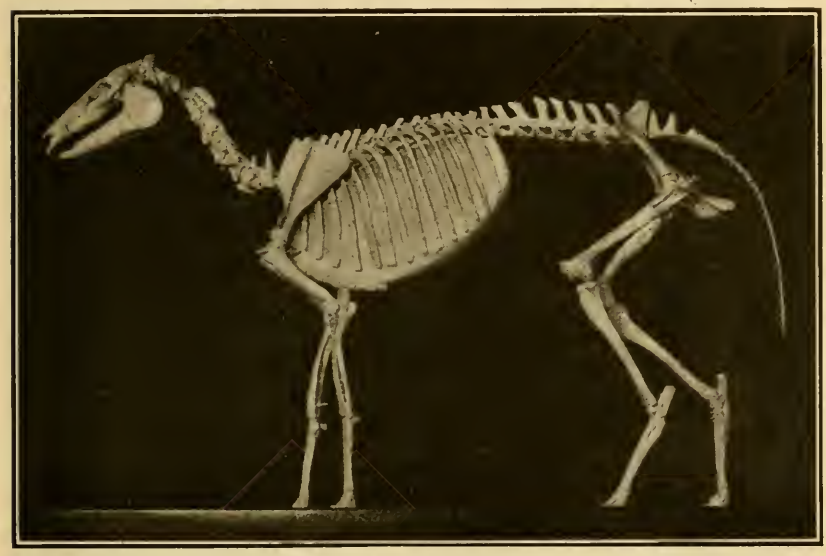


FIG. 2.—MESOHIPPUS BAIRDI.
Three-toed horse, Oligocene Epoch, South Dakota.

three-toed horse seven (see Fig. 2). The Neohipparion, a more advanced three-toed horse, has but six. The fossil Scotti horse found in Texas, six (see Fig. 4); the forest horse of Europe as represented by a skeleton of a Percheron has six (see Fig. 6); Henry Clay, an ancestor of the American Trotters, had six (see Fig. 5); and the Arab horse has only five (see Fig. 10, p. 93, *American Breeders Magazine*, vol. ii, no. 2). Thus the higher the type the fewer the bones in his loins.

Now let us follow in the same manner the bones of the foreleg. Figure 1, the three toes (fossil). Figure 2, the three toes (fossil).

Figure 4 the Scotti horse (fossil),[a]—showing only one toe and the two others reduced to nearly the size of the splint bones of the modern horse. Figure 5 the modern horse, Henry Clay, has splint bones more slender. Apparently here obtains the same law of elimination of superfluous bones as the higher types are approached.

On these lines Mr. Chubb of the Museum of Natural History in New York has made some discoveries that ought to be of interest and of material use to horse breeders. It has been known for some time that occasionally there is found on the foreleg of the horse an eighth carpal in very vestigial form. These carpals are the set

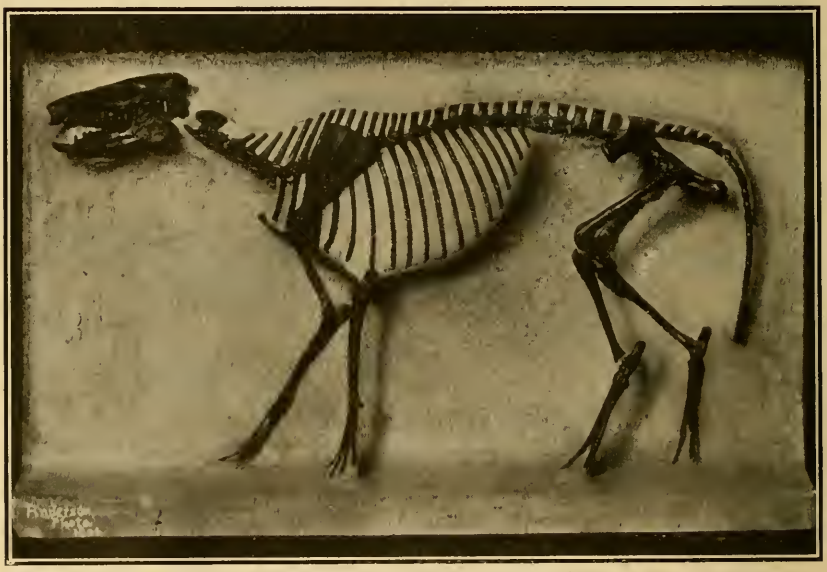


FIG. 3.—EOHIPPUS (PROTOROHIPPUS).
Four-toed horse, Lower Eocene, Wyoming.

next above the cannon bone. The first one in the distal (remote from point of attachment) row is the trapezium bone and is so small that it is difficult to find, being frequently overlooked when it does exist. This bone varies a great deal in size and shape, the largest about three-quarters of an inch long and tooth shaped. Wishing to know something about this little bone, Mr. Chubb obtained a number of horse knees from Barren Island and found the bone pres-

[a] It will be of interest to breeders to know that the fossil remains of the Scotti horse were discovered in Texas by J. W. Gidley. They are skeletons of young horses about a year old as indicated by their teeth, and as they are large for their age they must have been about the size of a draft horse when mature.

ent in 57 per cent of those examined. In one case, however, the bone was so placed that it impinged to such an extent on the trapezoid whenever the knee was bent that an irritation was set up and part

Fig. 4.—The First and Last Indigenous American Horses.
Large, *Equus Scotti*, Pleistocene Period, Texas; Smaller *Eohippus*, 14 inches.

of the bone absorbed in order to make space for the little trapezium. Unfortunately for breeders, Mr. Chubb took his material indiscriminately and made no selection of the several horse types in obtaining his specimens.

It would be very interesting to breeders to know if the law of elimination of this extra bone in the leg prevails with approach to the higher types, as appears to be the case in the vertebrae. Knowl-

FIG. 5—HENRY CLAY, AN ANCESTER OF THE AMERICAN TROTTER (NATIONAL MUSEUM, WASHINGTON, D. C.).
In the modern high type horse the body just fills the outlines of a square, that is, the distance from the ground to the withers is the same as from the front of the shoulders to the buttocks.
This is shown best in the skeleton of the horse Henry Clay. Compare this with the *Scotti* skeleton, Figure 4, which is very long and low in the withers. It will be observed that all the fossil horses have this characteristic, of long bodies, in other words, the horse as he evolved grew not only in size, but grew up in height.

edge on this subject should be of interest to veterinarians and horse breeders, for it is conceivable that if a race horse possessed a trapezium bone so large as to bump on the trapezoid bone every time he folded his knee he would be perceptibly impeded, if he did not in some cases

actually become lame every time he did really severe work. Among the specimens examined by Mr. Chubb he found one with still another vestigial carpal about the same shape and size as the eighth mentioned above. This is the only one on record and it suggests that the evolution of the horse is still going on, and that there are variations which may be individual, or which may belong to one specialized type.

FIG. 6—SECTION OF VERTEBRAL COLUMN OF A PERCHERON HORSE.
Showing six Lumbar Vertebrae. Museum of Natural History, New York.

If societies of horse breeders would take up the study of comparative anatomy of the several types of horses it seems likely we would learn something about horses which we do not know now. These trapezium bones may perhaps occur only in the mongrel horse and may rarely or never be found in specialized types of trotters, thoroughbreds or Arabs, but we do not know.

COLOR FACTORS IN THE HAIR OF THE HORSE

J. M. EGLOFF

Cedar Falls, Iowa

There has been much work done of late on the general question of inheritance of color in horses and many opinions have been advanced in regard to the basis of color. Many of these have been mere guesses instead of a careful study such as ought to characterize all scientific investigations.

With the object in view of learning if possible what really does determine or constitute color, the writer conducted the following investigation.

Thirty-three specimens of hair were collected from the various veterinary colleges located in different parts of the United States.

The colors were as follows: 6 black, 7 bay, 3 brown, 1 chestnut, 4 sorrel, 2 dun, 1 white, 2 gray, 2 mouse, 1 flea-bitten gray, 2 blue roan, 2 red roan.

Where only one of these is discussed, it will be understood that the specimens of this color are the same in essential, if not in absolute detail, as for example one might be a mouse color and another a dark mouse, etc.

As to the theoretical causes of variation, or the differences in coloration of horse hair, the theories advanced by investigators may be classed as follows:

(1) That the pigment granules are the same size but probably of varying numbers and certainly of three different colors, namely, yellow, brown and black, each representing a successively further oxidation of the same pigment base;

(2) The diversity in color is laid to a difference in number of pigment granules present;

(3) That the number of pigment granules is the same through all colors, but that the size varies, growing larger from sorrel to the black;

(4) That color may be affected by the density of the medullary layer; while it seems from my investigation that

(5) There is one other possible hypothesis, and that is that there is a differing arrangement of similar pigment granules which will produce the various colors according to the method of distribution.

DETAILED STUDY OF THE SPECIMENS

Series:—Sorrel, Dun, Chestnut, Bay, Brown, Black

Number 23, Sorrel.—The hair has a dark shaft. The pigment granules are scattered, being about equally spaced from each other and not clustered practically at all. The color effect under the low and high power is a light chocolate with perhaps a suggestion of orange or yellow, but this is due no doubt to dilution. Hairs of uniform sizes. The hide has the pigment granules massed giving it a somewhat deeper color.

Number 29, Dun.—The dun color seems to be really a roan, in that the hairs are not uniform in cross-sectional size (similar to the roans), the cortical layer chiefly varying. It has the white (unpigmented) hairs mixed in with the pigmented hairs. Those hairs which are pigmented seem to have the pigment granules gathered together to a slight extent. The color effect is a brown chocolate, but not

as light as was that of the sorrel. The individual pigment granules seem the same size as in the sorrel and the same color.

Number 14, Chestnut.—Here also we find quite a dark shaft in the hair.

The pigment granules are clustered quite closely and there is considerably more pigment present.

The pigment granules are the same size as before and of the same color. The color effect, however, under the low power of the microscope is a deeper brown due to the clustering of the pigment granules and the larger number present.

The skin in this slide seems to have the same kind of pigment present but the section is too thick for a detailed study.

Number 9, Bay.—The pigment granules are here found in quite regular clusters.

They are, however, individually, the same size as the former and of the same color.

The general color effect is about the same as Number 14, perhaps a trifle lighter.

There is also a scattering of pigment granules between the clusters all the way through the specimens so far studied.

Number 6, Dark Brown.—Here we find considerably larger clusters of the pigment granules with no pigment granules scattered between the clusters, as was observed in the specimens studied before.

The clusters are here not much larger (that is they do not contain many more pigment granules) but are much more numerous. The same pigment is seen in the epidermis but it does not seem to be there in the same amount, relatively speaking.

Number 19, Dark Brown.—About the same size of clusters found but they are very much more numerous than in Number 9.

The same color of individual pigment granules is still seen as well as the same size.

The color now passing through is a dark chocolate due to the thickness of the clusters. The skin has the same pigmentation but seemingly in relatively less numbers in comparison to the hair.

Number 8, Black.—There is here found not much increase in the size of the pigment granule clusters, but a marked increase in the number of the clusters.

The size and color of the individual pigment granules is the same. The same pigment is also present in the epidermis of the skin but not in as large proportions, evidently, as in the hair.[a]

[a] The clusters from the bay on, have not been markedly interspersed by the single granules.

Series:—White through Gray, and Mouse to Black

Number 7, White.—This specimen is not a true white. It has numerous white or unpigmented hairs along with hairs pigmented as are the black hairs except that the clusters are less frequent. (Many relatively large clusters of the chocolate pigment granules.)

The skin contains considerable of the chocolate pigment also. Hairs are of uniform size.

Number 11, Gray (Medium).—This specimen contains a mixture of the unpigmented and the pigmented hairs. The unpigmented hairs in this specimen being perhaps a trifle predominant.

The pigmented hairs are typical black hairs (pigmented with the many large clusters of the chocolate pigment).

Number 10, Mouse.—In this the percentage of pigmented hairs has been increased.

In these pigmented hairs the pigment clusters do not seem to be as large as the typical clusters found in the blacks or grays, and the general color seems to be a lighter chocolate due to more even distribution of the granules.

Number 4, Black.—Here we have again the many large clusters of the chocolate colored pigment.

Number 26, Red Roan.[b]—These are a rather un-uniform bunch of hairs in cross-sectional size. They are constituted of pigmented hairs with a mixture of possibly two-thirds unpigmented.

The pigmented hairs have practically the same characteristics of pigmentation as have the Bay (No. 9) and Brown (Nos. 6 or 19).

Number 26, Blue Roan.—This is found to be an un-uniform composite of black, brown and bay hairs with unpigmented white hairs.

The black, brown and bay show the same characteristics as above mentioned, in every respect.

The blue color of the blue roan is evidently derived from the black hairs present.[c]

Number 27, Flea-bitten Gray.—Bay hairs mixed with white (or white and a few black) in the proportion of about 8–60.

Here also the bay corresponds exactly to the bay above described.

[b] The roans: It seems probable from this study that grays and flea-bitten grays and also duns should be ranked as roans, the difference being mechanical, purely, in the distribution of the hair over the skin and also in the less frequency of pigment in the hair.

[c] It must be understood that black as commonly used is a misnomer, as it should be dark brown. Black, brown and bay have reference to external and not microscopic appearance.

CONCLUSIONS

From this study we see (1) that there is one color of pigment running through all colors of hair, (2) there is an increase in number of pigment granules from the lighter to the darker colors, (3) there is no apparent difference in size of pigment granules, (4) there is no apparent correlation between the size of the medullary layer and the color of the hair, with the exception perhaps of the grays, (5) and there is a very marked difference in the distribution of the pigment granules.

Through the sorrels there is an even distribution of the pigment granules, while through the dark brown and the black there is a very apparent clustering of the same. There is also an increase in the size and markedly in the frequency of the clusters toward the deeper colors.

From this we would deduce that seven factors may influence color, from the standpoint of inheritance. Namely: (*A*) Pigment factor, (*B*) Oxidizing factor, (*C*) Clustering factor, (*D*) Distribution factor, (*E*) Quantitative factor, (*F*) Pattern factor.

A. The pigment factor is pretty well understood in regard to its relation to inheritance. When present in connection with factor *B*, color is produced and in its absence typical albino forms result. The writer obtained no specimen of a true albino.

B. The oxidizing factor is also recognized by most investigators. Its effect on the chromogen or pigment factor is uniformly that of color production. In the absence of *B* typical albinos also are formed.

C. The clustering factor is merely hypothetical, although the clusters themselves are apparent. When the clusters are large or frequent less light passes through the hair and a darker effect ensues.

D. The distribution factor is perhaps the normal condition. The pigment granules in the sorrels show a relatively even spacing throughout the cortical layer and the bays show the same condition between the larger clusters. The combination of these two factors may show why bay is epistatic to so many other colors.

E. The quantitative factor is relatively simple. Increased pigmentation produces darker color effects whether in the presence of factors *C* or *D*.

F. The pattern factors are various according to the patterns that exist in all horse species. The roan and gray pattern has the greatest influence on the general color effect, (these two are probably almost identical) the amount of white influencing mechanically. It is probable that the series in which this factor is present is dominant to the sorrel, chestnut, bay, brown and black series.

HALLETT'S METHOD OF BREEDING AND THE PURE LINE THEORY

J. Arthur Harris

Cold Spring Harbor, Long Island, New York

Before the symposium on the "Genotype or Pure Line Theory of Johannsen,"[a] Professor Webber urged the importance of certainty concerning the validity of scientific theories before they are unqualifiedly commended as rules of conduct for the practical man. Selection has been the key of the breeder's success. In his practical operations it is impossible for him to know whether he is selecting "fluctuations" or "mutations," "modifications" or "biotypes." Much harm may be done, Professor Webber insisted, by assuring the practical breeder (on the grounds of an inadequately supported theory) that he may give up continued selection for a mere process of isolation.

In this connection, it seems worth while to lay before breeders a few paragraphs from the noted cerealist Hallett. His experience while pertinent to, and extensively discussed in connection with, modern theories does not seem to me to have always been clearly set forth.

From his main paper,[b] we learn certain facts which indicate clearly his belief that selection within the pure line can effect an improvement.

After discussing, among other things, methods of planting to allow for full individual development[c] he continues:

> Yet the minutest characteristics of a plant of wheat will be reproduced in its descendants; so much so, that we can not only perpetuate the advantages presented to us in an individual ear, but by the accumulation of selection, make further advances in any desired direction. . . . . To me it has always appeared that, while offering an earnest of what a better system would effect, the mode in which the best varieties of our cereals have been raised (that is starting with *accidentally*[d] fine ears, and simply keeping the produce unmixed without any *further* selection) is a very imperfect one, and that its attainments are perhaps of less value than the earnest which it offers of future

[a] Held under the auspices of the American Society of Naturalists at Ithaca, December, 1910. For papers see *American Naturalist*, 1911.

[b] Hallett, F. P., "On 'Pedigree' in Wheat as a Means of Increasing the Crop," *Journ. Agr. Soc.* 22: 371–381, plate. 1861. In 1869, Hallet formulated seven laws concerning the improvement of cereals. These may be read in *Sect. Trans., Rep. Brit. Ass.* (Exeter) 39: 113, 1870, or in *Journ. Bot.* 7: 293, 1869.

[c] The possibility of an accumulative effect of the especially favorable conditions under which Hallett grew his pedigree plants must, of course, be taken into account. There is, however, little reason for attributing to this physiological factor a rôle at all commensurate with that of selection.

[d] The italics are as in the original.

success under a more complete system, for such beginning (and *ending*, so far as selection is concerned) with an accidentally fine ear, is a very different thing from starting annually with one of a known lineage.

Hallett's method of selection is as follows:

A grain produces a "stool" consisting of many ears. I plant the grains from these ears in such a manner that each ear occupies a row by itself. . . . At harvest, after the most careful study and comparison of the stools from all these grains, I select the finest *one*, which I accept as proof that its parent grain was the best of all, under the peculiar circumstances of that season. This process is repeated annually, starting each year with the *proved* best grain, although the verification of this superiority is not obtained until the following harvest.

During these investigations no single circumstance has struck me as more forcibly illustrating the necessity of repeated selection than the fact, that *of the grains in the same ear one is found greatly to excel all the others in vital power.*

Two things are clear from this quotation. First, Hallett used fifty years ago the "ear to row" test so often emphasized as a modern method. Second, his method of selection in wheat, a generally self-fertilized plant, was essentially a method of improvement by selection within the pure line!

Again, in another place,[e] Hallett leaves no doubt as to his position regarding selection.

In the case of the potato, ... I have also applied my system, starting every year with a single tuber, the best of the year (proved to have been so by its having been found to produce the best plant), for now fourteen years. My main object has been absolute freedom from disease, and these potatoes are now descended from a line of single tubers, each the best plant of the year, and absolutely healthy; and concurrently with the endeavor to wipe out all hereditary tendency to disease, I have always kept in full view the point of increasing productiveness. The result may be thus shortly stated. Dividing the first twelve years into three periods, the average number of tubers upon the annual best plant selected was, for the first period of four years, 16; for the second period of four years, 19; for the last period of four years, 27, or nearly double the number produced during the first series of four years. And if, as I might very fairly have done, I had confined the first period to the first three years (instead of four), the last period would have shown an average of 27 tubers against 13 in the first period, or more than double. Here, exactly, as with the number of grains in the ear of the cereals, we reach in the last period of a long series of years, a standard altogether higher than in the first years of the series, and this no matter how we divided it into "periods." In the latter "periods" of a series of years the results vary according to season and circumstances; but (except in a case of disaster) in no year of the last year of a series *do they drop back to the standard of earlier years!*

[e] Hallett, F. P., "Food Plant Improvement," *Nature* 26: 91–94. 1882.

In quoting this paragraph I am quite aware that geneticists are wont to be sceptical of the opinions of the men who have worked primarily for practical results. When there is not a mass of quantitative evidence, scepticism is quite justified. On the other hand, the opinion of a man who says he has actually done a thing on a large and practical scale is worth quite as serious consideration as that of the man who on limited experimental evidence says it cannot be done. But laying this question of the critical value of Hallett's opinions aside, one must admit that if a man's results are to be cited in evidence at all they should be correctly set forth. I believe some serious misunderstandings of Hallett's view have followed erroneous descriptions of his work. These can perhaps be best corrected by fair quotations from his own pen.

THE DOMINANCE OF RECESSIVES

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If dominance is an absolute principle and its relation to recessives is immutable, our subject is an absurd contradiction of terms, but these suppositions are in no respect true. Especially within the zone of variety, dominance is an extremely variable quantity. Genetic factors operate from radiating centers which may be readily shifted by the potency of either side in any given mating, or by a variety of environmental conditions.

Although we then knew nothing of the Mendelian terminology, our attention was first attracted to the principle of dominance in the autumn of 1867, while herding cattle in southern Iowa. In covering portions of four counties we encountered large native orchards of Americana plums. Our previous experience in nursery and horticultural work led us to examine these orchards with absorbing interest. We everywhere found three colors—red, yellow, and mottled or blends. While large groups of the same color were generally found in close proximity, occasionally a specimen of distinct color and variety had maintained its individuality. When examined at blooming time it was found that there was an interim of several days between the time of blooming of the individual tree and the adjacent group.

We have at times been greatly amused at the labored explanations of some scientists who portray nature as adorning herself in a gay attire of many colors and performing all manner of gyrations, *à la*

ballet dancer, in order to attract cross fertilization. Wild trees of the same species often stand in such close proximity that the twigs interlace and yet they never crossbreed by reason of the discrepancy in their time of blooming. For lack of better terms, we denominated the conditions we found in these wild plum orchards as supremacy of color and individual potency. On clay hills and places surrounded by forest trees, the red everywhere predominated, but along ravines where the soil was very rich the yellow came to the front with the largest trees and best fruits. As the tallest grass grew in these places, it was evident that the yellow varieties had been the greatest sufferer from the ravages of prairie fires. This led us to conclude that supremacy of color, or what we now call dominance, was an environmental question. At the return of each spring and autumn these investigations were renewed.

In 1893 we began to cross-breed Americana plums, also to hybridize with Japans, with a view of testing the principles of supremacy of color, individual potency, survival of the fittest, and natural selection by surrounding the seedling with uniformly favorable environment. Before the seedlings fruited the writer removed to Colorado, being very careful that they should accompany him. When the seedlings began to fruit it was evident that climatic environment had wrought a change on all the varieties. High altitude and consequent aridity, low temperature and almost continuous sunshine had decreased all vegetal factors, changed the color of the fruit, and stimulated early bearing, but had not decreased the size, quality or quantity of the fruit.

The variety that first fruited and has since borne the most frequently is a hybrid which displays the greatest amount of response to climatic change. It, with several others, ranks with the best commercial varieties. Its early and continuous bearing, by reason of late blooming and its ability to reproduce itself, easily enables it to hold the place of dominance in Colorado; but in Iowa we do not think it could do this, on account of its diminutive size of tree.

By reason of early blooming the Japan hybrids proved to be of no value on the eastern slope of the Continental Divide. This experience with plum seedlings and hybrids left us in the firm belief that heredity and environment are the *tout ensemble* of plant breeding.

Soon after removing to Colorado, we began to experiment with corn with a view of producing an acclimatized variety of sugar corn. A search for a suitable base was rewarded by finding a small semi-

dent variety which for a generation had matured at an altitude approaching 8,000 feet. With open breeding, this was crossed with White Cob Cory. The result was phenomenal. The length of ear over each parent was increased from 35 to 50 per cent. The acclimatized parent dominated all vegetal factors, the root system, the height of the stalk, distance of the first ear from the ground, etc. Several specimens showed a combined ear length of from 35 to 47 per cent of the entire length of the stalk. A 55-inch stalk produced a 23-inch ear length and a 50-inch stalk one 13-inch ear. This sugar corn has been crossbred with other varieties and bred back with the original base. The latter method appears to produce the better result. An unlimited number of mutations have appeared. One of these has dark red stalks and blades and the husk folds terminate in very prominent blades which are tipped with spinelike points. Another has a stalk about 3 feet in length and trailing suckers from 3 to 5 feet long terminating in fair sized ears. It goes without saying that the mutation making the greatest progress toward perfect acclimatization will assume the position of dominance. In one or the other parent this may have been a latent or recessive factor receiving great impetus from favorable crossbreeding.

This sugar corn has been planted from promiscuous seed and by the ear to row method. It has been tested under favorable and adverse conditions with all dry land farming forage crops recommended by the experts and has outclassed the entire list. Both by irrigation and dry land farming corn was grown by the prehistorics in Colorado, New Mexico, and Arizona, and its possibilities under all environment found in the United States are the greatest of any cereal in the world. Any desirable kind or color may be produced by an intelligent recognition of the demands of climatic environment.

At about the time that the scientific world came into possession of Mendelian terminology the Rhode Island Red breed of poultry appeared in the West and the writer began to experiment with this breed in an effort to test the principles of heredity and dominance. They were selected as a base because they gave evidence of having been crossbred for many generations.

We began no less a task than that of determining the heritable factors that had entered into the composition of these birds by continued crossbreeding. Hence this germinal analysis by crossbreeding was done in order to determine what we already had, rather than what we expected to get. Our, then new, conceptions of heredity still left us firmly believing that evolution certainly evolutes, but we had become

very suspicious that the cat did not always jump in the direction prescribed by the theoretical formula.

For five successive years the results from breeding this breed were fairly uniform. The Red Game male of the original cross made a creditable showing at controlling the color, form, and beauty of the males. The females were strikingly recessive in all respects except merit; in this, they appeared to be conservators of the merit of all crosses that entered into their composition. They also outnumbered the males from 5 to 20 per cent. The sixth year there was an incredible increase in the number of males, many of which were recessive in color. This result was readily traced to a male bird introduced into the flock that season to secure new blood. More than 90 per cent of his progeny were males, not one of which held the dominant color. Thus he not only reversed the dominance of color which had been fairly well established by five years' careful breeding, but from a commercial consideration he violently reversed the law of the survival of the fittest. In two years he would have assumed complete mastery over a flock of sixty-five females and ten males. For his audacity in wrecking our "best laid plains," the insurgent, with all his kith and kin, was speedily banished.

In crossing Barred Rock female with Red male the offspring were all blacks and all females; 50 per cent were pure blacks and the remainder blacks with slightly mottled breasts and necks. Seven of these pullets were mated with a pure black males, supposed to be a Wyandotte-Minorca cross. Two hundred and twenty-five chicks were hatched from this mating at six different hatchings. As was to be expected, these chicks were not as uniformly black from both black parents as the first generation were from a Rock × Red cross. In the second generation there was nothing visible that could be classified as dominance. The potency of the male was no more in evidence than the individuality of the females. The females were more uniform in color, form, and size than the males. It was a marvelous ensemble of heredity. In the first hatch there was one Barred Rock; in the second, one white; in the third, two whites; in the fourth, one pure buff and one white; in the fifth, four whites; in the sixth, all black or near blacks. Rose combs prevailed in the first two hatches, singles in the last two.

Many of the chicks made a showing at having the dominant color characters as they neared full development, but began to recede at the first annual moulting. We had fine black specimens of five different breeds. The whites were Wyandotte-Minorca blends with very

dark legs, and the buff was a diminutive Cochin. All that we expected to get in the second and third generations we got in the second.

Atavism was the most striking feature of this experiment. This is true of all second generation hybrids and crossbreds. It is also true that most, if not more, of the genetic phenomena usually classified as evolution is nothing but atavism. Mutations and so-called sports are the most immediate result of the infinite number of possible combinations of Mendelian pairs. In these combinations the pairs of an almost infinite number of preceding generations are to be taken into account. When the potency of two or more correlative factors is nearly or quite equal, dominance loses control, resulting in a compromising blend. More than 65 per cent of our second generation chicks were such blends.

To some extent, atavism may prevail in the most exclusive artificial fertilization. We place paper sacks upon the tassel and silk of the corn and mantle our trees to exclude foreign pollen. We pronounce our "mirabile dictus" on the evolutionary changes and hold our ear to the earth to hear the much coveted title, Wizard! This is to laugh, for what we got may have been an ordinary bit of heredity. From the same parents we are obtaining three apparently distinct breeds of chickens. While on the face of the returns they are new breeds, in reality we are only perpetuating the heredity of original crosses.

POSSIBILITIES FOR A NEW BREED OF CATTLE FOR THE SOUTH

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Although nothing definite is known concerning the origin of Zebu, or Brahman, cattle (*Bos indicus*), Professor Lydekker[a] thinks that they originated in the Middle East (the Indo-Malay countries) where they are indigenous. The Zebu was domesticated probably 4000 B.C. or earlier, and spread from Asia to Africa, so that from ancient times the distribution has been much the same as now. Aristotle and Ossian knew of the Zebu in Syria, 27 B.C. It was described in Buffon's *Histoire Naturelle*, published from 1749–67, and the following fair description of them is taken from an abridged English edition of this work published in 1821:

[a] Lydekker: *The Ox and its Kindred.*

FIG. 1—TYPICAL BRAHMAN BULL.

FIG. 2—TYPICAL BRAHMAN BULL.

In the whole continent of India the islands of the South Seas; in all Africa, from Mount Atlas to the Cape of Good Hope, we find nothing but hunched oxen; and it even appears that this breed, which has prevailed in all hot countries, has many advantages over the others. The hunched oxen . . . . have the hair much softer and more glossy than our oxen, who, like the Aurochs, are furnished with but little hair which is of a harsh nature. These hunched oxen are also swifter, and more proper to supply the place of the horse; at the same time they have a less brutal nature and are not so clumsy and stupid as our oxen; they are more tractable and sensible as to which way you would lead them.

In describing the hump the account further proceeds:

This hunch does not depend on the conformation of the spine nor on the bones of the shoulder; it is nothing but an excrescence, a kind of wen, a piece of tender flesh, as good to eat as the tongue of an ox. The wens of the oxen usually weigh forty to fifty pounds; some have them much smaller.

There are many breeds of Brahman cattle, and on the whole they appear to present a hybrid-complex analogous to that of *Bos taurus*. They appear in several colors, sometimes unevenly distributed over the body, creamy buff, brown, ashy gray, red, black, and white being the most prominent. In most of the breeds there is a large dewlap commencing close to the chin. The forehead is generally convex, the part above the eyes being quite short. The horns of the breeds from southern India are small but in other parts of India and all of Africa, they appear to carry large horns. Their sizes vary greatly, ranging from dimunitive breeds to those the largest individuals of which weigh upwards of 2000 pounds, and the males are larger than the females. The noise they make is more of a grunt than the low of *Bos taurus*. It appears that the hump, dewlap, sheath, horns, shape of head, color and the voice may be tentatively considered as well defined characters, but their genetic values have not as yet been determined.

They have been carried to nearly all parts of the world, especially to the tropical and subtropical countries. The strong draft oxen of Spain are the descendents of Brahman, crossed on Spanish cattle. They have been imported into Borneo, New Guinea, and many South Sea Islands, to Brazil, Jamaica, Mexico, and the southern United States. In fact, there is hardly a tropical or subtropical country into which they have not been introduced.

Reports from cattlemen from a number of the countries, to which they have been carried, indicate that they and their hybrid progeny are peculiarly well adapted to the tropics. They are said to be

FIG. 3—BRAHMAN COWS.

immune to all the destructive tropical cattle diseases. The Director of Agriculture of Jamaica writes that since the introduction of Brahman cattle the mortality of calves in the island has been reduced from 25 per cent to 6 per cent. Dr. J. Carlos Travassos, in the *Monographias Agriculas*, states that in northern Brazil, the imported Brahmans and their hybrid progeny are peculiarly fitted to resist the diseases and insect pests to which the European cattle easily succumb. According to this author, reported in a circular issued by Mr. Carl Hagenbeck, the same situation prevails in the several other tropical countries to which these cattle have been taken. A few hybrids have passed the winter on Colonel Goodnight's ranch in northern Texas and they resisted the severe winter weather of 1911–12 as well as, if not better than, the northern cattle. It is to be noted that the range of their distribution in India is all the way from the extreme tropics to the very cold regions of Thibet.

It seems that Zebus or Brahman cattle were first brought to the United States in 1849 by Mr. Davis of South Carolina. But their characters may have been long before that time introduced into the Southwest through Mexico from Spain, where it is known that the Zebu had been early introduced. It seemed that the Davis cattle were subsequently taken westward and their progeny distributed throughout the Southwest and Mexico. The thriftiness and resistance to ticks made these cattle favorites with stockmen, and it has been suggested by some cattlemen that the success in cattle raising on the range in southern Texas and other parts of the Southwest, during the middle and latter half of the last century, was due largely to the early introduction of these Davis and other cattle carrying Brahman characters. It has been further suggested that the elimination of these resistent characters through the later introduction of the Hereford, Durham, and other non-resistent beef cattle from the north accounts for the present difficulty in raising cattle on the tick and insect infested ranges and pastures.

The great hindrances which the ravages of the cattle tick and its attendent evils place in the way of beef raising in the South and Southwest, is being charged up in these days as some of the factors of the beef famine. The editor of the *Scientific American* (October 12, 1912) states that in North Carolina there are six persons to each head of cattle of the value of $12.60; in Georgia there are four persons to each head valued at $11, and in Mississippi three persons to one head valued at $10. In a recent Department of Agriculture publication, (*Farmers' Bulletin* 498) Dr. H. W. Graybill says:

The eradication of the cattle tick (*Margaropus annulatus*) from the southern states is a problem of prime importance to the agricultural interests of that section. The elimination of the tick would give a tremendous impetus to the cattle and dairy interests of the South, place southern agriculture on a more scientific and profitable basis, and, as a consequence, give a greater measure of prosperity to the South as a whole. Although the extermination of the tick would be of the greatest benefit to those states in which the tick now occurs, the benefits resulting therefrom would not be confined to them, but would be enjoyed to a greater or less extent by the rest of the country, in consequence of which the problem becomes, to a certain degree, one of national importance.

In the portion of this bulletin entitled "Reasons for Eradicating the Cattle Tick" the author pictures a perfectly true situation in regard to the direct damage caused by the tick and the induced evils so astonishingly bad that it is not surprising in the least that the numbers of cattle in the various states are so exceedingly small. Some of the points developed are as follows: the tick in drawing blood from the cattle emaciates them, thus making it quite impossible for the young cattle to reach their full size or to become fat, however well they may be nourished. The tick is the carrier of organisms which causes splenetic fever (Texas fever), a disease which causes the loss, unless they be immunized at great expense, of 90 per cent of the cattle brought in from outside the tick area. This situation has caused the government to maintain a quarantine line which extends from the coastline of southern Virginia across the country to the southwest boundary of Texas. This necessary quarantine makes the shipment of cattle northward across this line almost prohibitive, while, as already stated, the shipment of cattle southward without the costly immunizing process, cannot be considered. On this account, breeders in the South cannot exhibit their cattle in the North, and the exhibition of northern cattle in the South is seriously interfered with. The total loss annually from the ravages of the tick has been estimated at $40,000,000 to $100,000,000.

The seriousness of the situation was realized by stockmen as early as the 70's and 80's. About the year 1880, Mr. A. H. Pierce, of Pierce Junction, in southern Texas, conceived the idea of introducing more Brahman cattle. Concerning this introduction and the physiological and anatomical reason, for the immunity of these cattle and their hybrids, to the bite of the tick, Dr. John R. Mohler says:

These animals were crossed with our domestic cattle and the resulting influence on the herds was markedly apparent. One of the most interesting observations was that their progeny remained relatively free from ticks, while

other stock in the same pasture would be literally covered with the pests. The cattle ticks are present in such enormous quantities in this section of Texas as to make cattle raising much less profitable than it should be. This is due not so much to the fact that these ticks carry the Texas fever micro-organisms as to their great blood-sucking powers as external parasites. The Brahman grade cattle appear likewise to be less affected by other parasites and pestiferous insects, such as mosquitos, horn-flies, gad-flies, etc., and to withstand better the warm dry climate and other semitropical conditions present in the Gulf coast sections than do the native cattle. . . . .

The sebum secreted, by the sebaceous glands of the skin has a peculiar odor which seems to be repugnant to insect life. The hide, while it may be as thin as in our domestic animals, still appears to be much tougher and is much more difficult to penetrate with a hypodermic needle. The hair is quite short and does not provide favorable shelter for the development of the ticks. These three factors are probably responsible for the slight amount of tick molestation which these animals experience.[b]

In 1906 Mr. A. P. Borden, imported another herd of about 30 head of Brahman cattle, mostly young bulls, and he crossed these extensively on native Texas cattle and purebred Herefords, and Durhams and grades of these. Mr. Borden's experiences in importing these cattle are interestingly related in his paper "Indian Cattle in the United States."[c]

In September, 1911, I was kindly permitted to visit the herds at Pierce for the purpose of studying them and making photographs. The preliminary observations made on this visit were published in the *American Naturalist*, vol. xlvi, no. 547. It was observed then that whenever Brahman cattle are crossed on pure or grade Herefords the color and other characters of the latter are, on the whole, dominant in the F_1 generation, and when the cross is on grade or pure Durham the characters of these are dominant in the F_1 progeny. However, a slight hump, a considerable dewlap and sheath similar to that of the Brahman, appear in all the F_1 progeny observed, so that the result is not far from a blending of characters. This observation is not in accord with Professor Lydekker's statement *The Ox and Its Kindred*, p. 248) that "The steers, at any rate of the hybrids hitherto produced, are strikingly like the male parents (Brahman) having well developed humps, large pendent ears, and showing more or less white in the neighborhood of the fetlock." The above statement appears to be based on the work of Mr. Carl Hagenbeck in breeding hybrids, but from the descriptions and photographs of his hybrids, contained in a circular sent me by Mr. Hagenbeck, it is not easy to

[b] Twenty Sixth Annual Report of Bureau of Animal Industry, Department of Agr., 1909, p. 84.
[c] *The American Breeders Magazine*, vol. I, no. 3.

see how Professor Lydekker could have arrived at his conclusion. Also in British East Africa, where experiments are being carried on in crossing Herefords and Shorthorns on the native cattle, of Brahman blood, it appears that the characters of the European cattle are dominant in the F_1 progeny.[d]

It was observed also that when the Brahmans were crossed with native "Texas cattle" the resulting F_1 progeny, in some cases at least, resembled the Brahman parents mostly, but this is probably due to the fact that the native cattle already have Brahman characters in them, their desirable qualities having favored their perpetuation since the early introduction.

FIG. 4—CALVES FROM F_1 BRAHMAN-GRADE DURHAM COWS.
Bred back to Durham, show nearly pure, if not pure; Durham on left and typical hybrid on right.

It was further observed in the F_2 generation that there was apparently complete segregation and that the ratios appeared to approximate fairly closely the Mendelian expectations. However, it has been pointed out to me since that some of the grade cattle of the original crosses probably carried Brahman characters, a matter which was given cognizance (*loc. cit.*). Although this fact does not preclude the idea of Mendelian segregation, yet it might indicate other than a simple 1:2:1 ratio. As a matter of fact, observations made this summer and to be described later, indicate that the segregation is not so simple as it at first appeared to be.

[d] *Outdoor World*, and *Recreation* November, 1912.

In the paper cited it was noted that the claims made concerning the immunity to ticks of the Brahman and their hybrid offspring were well founded. Also that the hybrids average much larger (as much as 50 per cent) than the native or Hereford or Durham cattle kept under similar conditions, and that they are far more prolific. A male will impregnate 75 or 80 cows each season as against 25 or 30 impregnations by the Hereford or Durham.

In August of 1912 I was permitted to visit the Borden herds again. The time was limited and the information that could be given me was

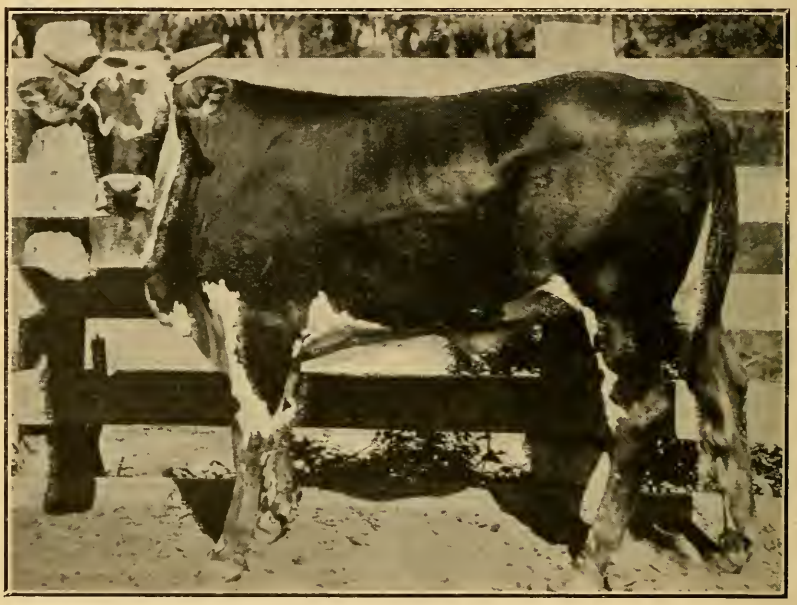


FIG. 5—BRAHMAN-HEREFORD F_1 HYBRID.

This Heifer weighed 1000 pounds at twelve months of age. She was tick-free on a tick-infested pasture.

extremely meager, so that the records made were even less adequate and less satisfactory than those made last year. Under the conditions of the experiment this situation is likely to become less satisfactory each succeeding year. It was not possible to study the calves and yearlings (now yearlings and adults) observed in 1911, because it had been necessary to separate them, many of them having been sold and the others mixed in such ways that nothing could be determined concerning their ancestors. One bunch of F_2 males from the different herds observed last year (*loc. cit.*) ranged in appearance all the way from an apparently perfectly pure Durham (*loc. cit.*, fig.

5, left) to nearly pure Brahman. However, a perfect Brahman was not seen. There were some with the full complement of hump, dewlap, sheath, ears and perhaps some other characters, but in each case some one or more characters was lacking.

In one herd of forty-five to fifty Brahman-grade Durham hybrid cows that had been bred back to pure Durham, three, possibly four, of the calves appeared to present the characters of the typical Brahman-Durham hybrids, while two or three appeared to be pure Durham (fig. 4). The others, about forty calves, varied between these two types, most of them ranking as apparently midway, or three-fourths Durham. Thus it appears that there may be a kind of blending such as Castle found in size and bulk characters of rabbits, or as later sug-

FIG. 6—BRAHMAN HYBRID COWS AND CALVES.

The cows are F_1 hybrids from Brahman on high grade Hereford, and the F_2 calves are from these hybrid cows bred back to Brahman.

gested by the same author, "Unit character segregations may really occur, though their presence is obscured because dominance does not occur."

In another herd of Brahman-high grade Hereford hybrid cows bred back to Brahman, some of the calves were strictly of the hybrid type while some were mostly of the Brahman type, except for one or more characters, either the color or complete hump, droop of the ears, shape of the head, or something else. No perfect Brahman was observed among thirty-five or forty calves (Fig. 6). However, it may be noted that there are only a few, if any, that can be considered anywhere near three-fourths Brahman and one-fourth Hereford—they range from midtypes (hybrids) to pure Brahmans, except for a character or more.

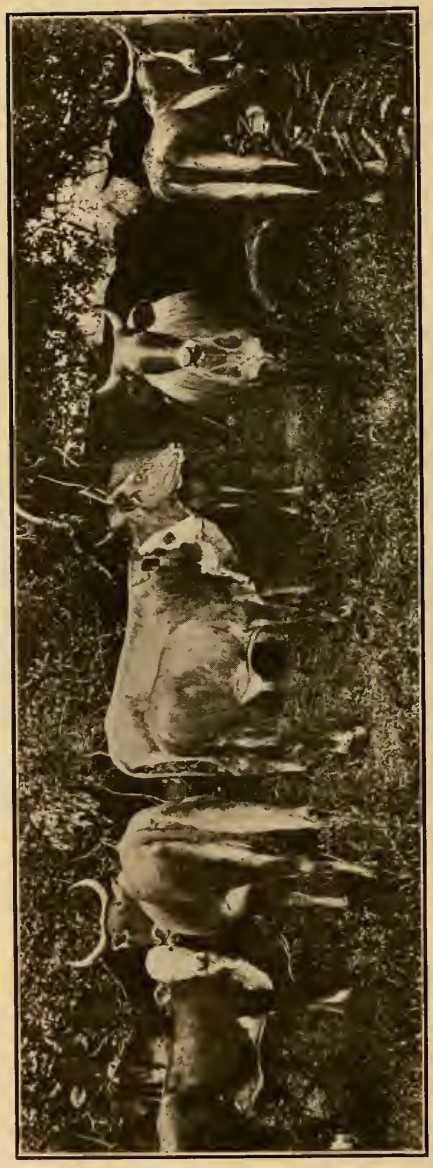


FIG. 7—BRAHMAN-HEREFORD HYBRIDS.

The cows are Brahman-high grade Hereford F_1 hybrids and the F_2 calves are from these cows bred to a Brahman-Hereford F_1 hybrid bull.

In another herd of F_1 Brahman-high grade Hereford hybrids which had been mated to a Brahman-Hereford F_1 hybrid male, F_2 calves were found of many types from nearly pure Herefords (always lacking a character or more or having, in part at least, one or more Brahman characters) to a nearly pure Brahman (lacking one or more Brahman characters or having one or more Hereford characters) (figs. 7 and 8). There were about 50 calves in this herd. It was not possible, under the circumstances of the study, to place the different types into groups and to ascertain the ratios. An effort to do this from horseback failed, yet I am confident it could be done.

The only F_2 specimen of last year's study to be observed particularly was the apparently pure extracted Durham now a year and a half old (*loc. cit.*, fig. 5, left). He is quite small and still shows no trace of any Brahman character. The purpose in examining him closely this time was to see whether he is immune to the ticks. But it was found that the ticks had been apparently completely eliminated from the pasture on which he was grazing, so no test of this kind could be made. So far as I could ascertain in the short time that could be given to an examination of the grounds and cattle, it seems that there are no ticks now on the pastures which have been used exclusively for Brahman and grade Brahman cattle for a year or more. It is desirable, however, that a further examination be made by some person trained in the work of detecting ticks before it can be safely said that no ticks at all remain.[e]

Summary and conclusions.—The origin of the various breeds of Brahman cattles (*Bos indicus*) is as obscure as that of the breeds of *Bos taurus*, though the best opinion seems to point to an Indo-Malayan origin for the species as a whole.

Brahman cattle have been introduced to many, if not all, tropical and subtropical countries. Reports from the stockmen of these countries are invariably favorable. The Brahman cattle and their hybrids appear to resist the cattle diseases endemic to the tropics. They are either not bitten by ticks and insects pests, or are not injured by them.

They are not strictly confined to warm countries, but appear to do well in such cold climates as northern Texas and in the high cold altitudes of Thibet.

[e] Mr. J. H. Hutchins has lately investigated this matter for me. The pastures have not been used at all times exclusively for Brahman and hybrid cattle and are not entirely free from tick infestation.

FIG. 8—BRAHMAN HYBRID CALVES.

From the same herd as figure 7. These calves are good examples of segregation in the F_2 generation.

It is not known when Brahman characters were introduced into the United States, but mostly, probably, they first came in with the Spanish cattle early introduced through Mexico from Spain.

The success in raising cattle in the Southwest during the latter part of the last century was in large part due to the tick and insect resistant character or characters of these early introduced Spanish cattle and later to the Davis, Brahman, and Brahman grade cattle.

It is suggested that the decline in cattle raising in this region is in some part due to the more recent introduction of the non-resistant beef cattle of the northern states, which has largely eliminated the resistant characters which make up, in part, the native "Texas cattle."

It appears that the first hybrids from the crossing of Brahman bulls on pure or high grade Hereford or Durham cows give F_1, offspring that average, under the same living conditions, 50 per cent or more larger than the Herefords, Durhams, or native cattle, and they are better "rustlers."

The Brahman bulls are far more prolific than Hereford, Durham, or native cattle.

In Texas and Germany it appears that the characters of the Hereford or Durham are, on the whole, dominant in the F_1 generation in the crossings where the Brahman males are used. In British East Africa it appears that the characters of the Hereford and Shorthorn are dominant in the F_1 generation in the reciprocal crosses where the Hereford and Shorthorn males are used.

There is perfect segregation in the F_2 generation, but the conditions of the experiment, especially the lack of records, and facilities for study are such that the number and kinds of factors cannot be ascertained. It appears, however, that the peculiar horns, dewlap, and sheath, drooping ears, large hump and color may be unit characters.

It may be that some of the size and bulk characters blend permanently or that a hybrid complex might be created that would breed very closely true to some new type which would combine the tick, insect, and tropical disease resistant character of *Bos indicus* with some of the desirable beef or milk characters of *Bos taurus*. The use of first hybrids, at least, from *Bos indicus* on *Bos taurus*, might greatly facilitate the work of eradicating the Texas cattle tick and the splenetic fever transmitted by it from the pastures and ranges in the southern states, and thus prevent the loss of many millions in money each year. Enough is now known concerning this matter to warrant

preliminary tests being started at once.[f] In the event preliminary tests should confirm conclusively the idea that the pasturing of hybrids on land will thoroughly eradicate the tick from it, farmers and stockmen would no longer resist the efforts at eradication but would join in heartily with the work.

Whatever agency may concern itself with the handling of this work, very careful genetic records should be kept; and the larger the project, the greater the opportunity for studies in cattle genetics. It has been a great loss to science that a genetic record of the Borden herds has not been kept.

I desire to express my deep appreciation of the courtesy shown me by Mr. Borden and Mr. Pierce Withers, and my thanks to Prof. T. J. Headlee and Director Ed. H. Webster, who were instrumental in making possible the trips for the studies.

"If Eugenics is to enter the national life of the American People, not only the ministry, but the educators, the editors, the public lecturers, the doctors, the political leaders, and the social workers, and, in short, all classes and professions that play a part in leading public opinion must get right on Eugenics. I feel that the first thing they must understand is that at root Eugenics is a biological problem, and that its truths cannot be arrived at by arbitration and discussion. It concerns primarily the natural inheritance of human traits, and truth can be found out only by first hand observation and analysis."—H. H. LAUGHLIN.

"Man may select and preserve each successive variation, with the distinct intention of improving and altering a breed, in accordance with a preconceived idea; and by thus adding up variations, often so slight as to be imperceptible to the uneducated eye, he has effected wonderful changes and improvements. . . . . As the will of man thus comes into play, we can understand how it is that domesticated breeds show adaptation to his wants and pleasures. We can further understand how it is that domestic races of animals and cultivated races of plants often exhibit an abnormal character, as compared with the natural species, for they have been modified not for their own benefit, but for that of man."—CHARLES DARWIN.

[f] It is not desirable that general and promiscuous experimentation be inaugurated. The experiments should be supervised by trained men in connection with some responsible institution.

PRESIDENTIAL ADDRESS: NINTH ANNUAL MEETING[a]

Hon. James Wilson

Secretary of Agriculture, Washington, D. C.

Considering the preliminary meeting held at St. Louis nearly ten years ago, as the birth of the American Breeders Association, the ninth annual meeting marks the first decade of its life. You have honored me with the presidency during this period. I want to thank you for this honor and to express regret that I have not been able to meet with you more frequently. I wish also to review, briefly and appreciatively, the history and the work of this organization.

Your secretary, Mr. Hays, upon his return from the first Hybridizer's or Genetics, Congress in London in 1899, brought to my attention the need of the American Breeders Association and requested that I suggest a method of procedure that might bring about such an organization. His recollection is that I recommended the formation of a committee for that purpose by the Association of American Agricultural Colleges and Experiment Stations. Such a committee was formed in 1901, with Mr. Hays as its chairman. The other members of the Committee were Director L. H. Bailey of Cornell, Prof. T. F. Hunt of Cornell, Dean C. F. Curtiss of Ames, Iowa, and Dr. H. J. Webber of the United States Department of Agriculture.

Some delay was occasioned in the calling of the first meeting by the intervening international meeting of hybridizers, under the auspices of the New York Horticultural Society. The first meeting which was really of such character that it might be considered an annual meeting was held in the city of St. Louis in December, 1903. This meeting was well attended and a goodly number of splendid papers were presented. The next annual meeting was at Champaign, Ill., early in 1905. The proceedings of the preliminary meeting and of the Champaign meeting were published as the first Annual Report of the Association. Following this first annual meeting successive annual meetings were held at the following places: Lincoln, Nebr.; Columbus, Ohio; Washington, D. C.; Columbia, Mo.; Omaha, Nebr.; Columbus, Ohio; and Washington, D. C.

The published work of this Association has been permanently recorded in eight bound Annual Reports, three volumes of the *American Breeders Magazine*, and various bulletins of the Eugenics Section of the Association. These reports and magazines and bulletins

[a] Address of the Retiring President of the American Breeders Association, January 27, 1913, at Columbia, South Carolina.

undoubtedly contain the best body of knowledge published under any auspices relating to the technical study of genetics, eugenics, and plant and animal breeding. The work of Mr. Hays, Dr. Davenport, Dr. Webber, Professor Spillman, and others who have persevered in building up this Association has been a work of love for the cause, but it will pay in dividends to the country and to the world.

Those of us who have not been able to attend the meetings regularly and have often thought that the Annual Reports and even the quarterly *Magazine* have been rather abstract in nature have not fully realized the significance of this organization's work. One year ago I had the pleasure of making a brief address at your meeting and of listening to one of your able members, Dr. H. H. Goddard. His address, so clearly showing the hereditary nature of feebleminded-ness and so clearly suggesting the possibility of eliminating this strain of weakness from the heredity of the human family, thoroughly aroused me to the importance of the work you are accomplishing.

This Association has clearly blocked out for itself a new field. It has already done much to give direction to research work relating to heredity and to breeding. Through its conferences, public addresses, and publications it has done much to give direction, interest and impulse to the work of introducing new plants and animals; creating new varieties, families, and breeds; and encouraging the wider distribution and use of the more efficient strains of plants and animals.

This organization has rendered material assistance in developing the men who, in the United States Department of Agriculture, in the State experiment stations, and under other public and private auspices, are leading in the development of the science of breeding and in the creation of improved forms of pedigreed plants and animals. It has stimulated the organization of clubs devoted to genetics and eugenics in our centers of learning and in our large cities. It has given ideas to universities and colleges, leading them to the establishment of lectureships and chairs of genetics and eugenics.

Its publications have begun, finally, to influence widely the discussion of breeding in that section of the agricultural press which deals with the improvement of our domestic plants and our domestic animals. And the day is rapidly approaching when our live stock papers will more and more follow the lead of the publication of this organization as to the facts and philosophy of breeding.

You have done much to make the names of such men as Mendel, DeVries, and Burbank widely known throughout the entire country. You have given inspiration to many who in public or private station

are taking up the study and the practice of scientific breeding of plants and animals. You have developed and put forward broad policies for the organization of plant breeding and animal breeding, and latterly you have so developed the subject of eugenics that the entire country is aroused as to the vital importance of the science of human heredity and the application of this science to the improvement of the human family.

You have not only brought together in one unified organization and movement the breeders of plants, the breeders of animals, and those interested in eugenics, but you have also brought together the scientist and the practical breeder; and in addition you have, in your membership, brought together many of the leading genetic scientists of the world.

You have developed in your eugenics section a great experiment station and institution of research, with a splendid building called the Eugenics Record Office, containing fire-proof vaults. Your eugenics laboratory extends out from this record office and embraces the lives of the people. Your laboratory material is the heredity that runs through the veins of the good, bad, and indifferent families of our great country. Your one or two dozen scientific eugenists who are devoting their time to assembling the genetic data of thousands of families in these fire-proof vaults are making records of the very souls of our people, of the very life essence of our racial blood. As these genetic genealogies are recorded, new values will be given to families. Those families which have in them degenerate blood will have new reason for more slowly increasing their kind. Those families in whose veins runs the blood of royal efficiency will have added reason for that pride which will induce them to multiply their kind.

The foundation which this Association now has already created upon which to build its future work is broad and substantial, and the field of opportunity is large. Up to this time there have been many advantages in having in this Association a relatively compact organization of specialists. Without the disadvantage of an unwiedly membership clamoring for more popular publications, you have been able to lay down the fundamental lines of work which a general organization of this kind can do. You have not sought to encroach upon the lines already undertaken by such public institutions as departments of agriculture and experiment stations. You have rather confined your efforts to supplementing these agencies along those lines which their interests do not cause them to wholly cover.

But the time has come when you are approaching a new situation, in part the result of your own work. The public is becoming

aroused as to the importance of more science in the breeding of plants, animals, and men. These important subjects are getting into the courses of study of our colleges and universities. Associations of different kinds are beginning to discuss genetics, and especially those lines relating to human heredity. The demand is arising that the people be taught these new facts as rapidly as they are developing. The accumulation of genetics family records by the Eugenics Record Office and the facts and philosophy growing out of this work are creating a demand that the results be made available to the public. Young people who fear that common weakness on both sides of the proposed family may result in inefficient children or in unfortunate tendencies are beginning to knock at your doors for this knowledge. The colleges and universities of the country are coming to see that they need your help in bringing into our school system sane instruction relating to heredity and eugenics. The press is frankly open to the statements which your leaders may care to write. Book publishers have already shown their confidence in the popularity of eugenics, as well as in the newer philosophy of plant breeding and animal breeding, by beginning the publication of books written by your members. The public is showing a great interest in the lectures which deal with the subject of eugenics.

Even people of means are beginning to look to your organization as an avenue through which they may serve the world by placing endowments in the hands of your scientists, to put forward the science of genetics and place eugenics as well as plant and animal breeding on a scientific basis.

A new line of public service has recently developed which promises more far-reaching results than those relating to improvements through breeding: The work of our agricultural research institutions has demonstrated that we can slowly but surely and very economically increase production by finding those best families, strains, varieties, breeds, and sub-breeds which yield the largest net profits per acre or per farm, and multiply them so that they will supplant all inferior forms. To so educate, place in position of advantage, and reward the best part of the human race that they will rapidly multiply and become the great improved body of people which can best utilize the opportunities of this beautiful earth at first seems like an Utopian vision. Like world peace, however, it may come; and may we not all ask; Why should it not come? Must science stop in its beneficence with the plant and the animal? Is not man, after all, the architect of his own racial destiny? Cannot the best people of the best races be wise enough to multiply and become dominant in numbers as well as in efficiency and goodness?

May I not appropriately commend in the highest terms the sanity and care with which you have developed this organization? The placing of the group of trained genetic scientists in the leadership in the new and delicate field of eugenics has proven to be a matter of national importance. This subject, has on this account doubtless escaped a period of pseudo-science and has plunged at once into a discussion of vital problems.

The organization of the Eugenics Section is alone of sufficient value to repay for all the time, energy, and money expended on this organization.

People who wish to use surplus means in the endowment of public work will make no mistake by placing goodly sums at the disposal of the American Breeders Association. I observe that you are publicly asking for a foundation of half a million dollars. Twenty times that sum, or ten millions, would come nearer the mark. The subject of eugenics alone, which can be better developed under a public welfare association such as this than under governmental auspices, needs large endowment. Besides, there are many lines of research and initiative in the creative breeding of plants and animals which in the natural course of affairs will lie in the twilight zone between the activities of public agencies and those of private and commercial agencies. There will be no end of practical projects which will present themselves. Furthermore, this organization has open to it a very large field in purely scientific research along genetic lines.

The largest immediate need of the Association doubtless is means with which to develop its service in relation to public education, to popularizing the facts already known or assumed to be known. You need officers to build up your publications. The *American Breeders Magazine* is especially worthy of support. As a monthly it would have a field as large as that of the *National Geographic Magazine,* which now goes out to one hundred and sixty-five thousand members. Every breeder and grower of pedigreed plants and animals, as well as every person interested in eugenics will find membership in this Association useful and the Association most pleasant. You need other officers to coöperate with universities and other institutions of learning, with the church, and with other organizations which are in position to lead the people aright in matters relating to eugenics.

You have laid the foundation for a great public service organization. I am proud to have been your president. I thank you for the honors and courtesies, and I shall watch with great interest your further development.

Buffalo Herd, 130 in Number, on Ranch at Goodnight, Texas.

Three of Colonel Goodnight's Cowboys.

Buffaloes on Goodnight Ranch Being Specially Fed as They had Lost in Flesh during the Severe Winter Weather.

EDITORIALS

THE NOVICE NEEDS PROTECTION

When the farmer or the city man decides to engage in the breeding of pedigreed live stock, he too often becomes the victim of unscrupulous dealers and traders who lie in wait seeking whom they may fleece. These are the men who are most likely to know of his decision and the most ready to volunteer their services and advice. The inexperienced, being largely ignorant of blood lines and values, is an easy prey.

It is only a question of time when the victimized breeder realizes his mistake, and in a majority of instances this experience, coupled with lack of experience in proper methods of care and management, disheartens and disgusts to such an extent that he abandons the business for good and for all.

The legitimate breeder has not profited, certainly not the loser. Justice is seldom meted out to the unscrupulous until his victims are numbered by the score or by the hundred. There is no way to protect the novice except as he confides in and advises and deals with reliable breeders. The army of reliable breeders is large but needs recruiting. Pedigreed record associations, backed by a majority of reputable breeders, should more courageously exclude from membership in their association any one earning an unsavory reputation. They should guard their own transactions with such uprightness and regard for straightforward and clean-cut honesty that they can fearlessly assist such work. Then and not till then will the novice be reasonably secure.—Herbert W. Mumford.

THE MARRIAGE LICENSE CLERK

The Very Reverend Dr. Summers of Chicago has effectively started the discussion of the desirability of requiring medical examination of persons who contemplate marriage, that the state and the church may avoid joining in wedlock those who cannot bear normal children. Since the theme has been accepted as one open to general discussion it would seem but natural that its scope be broadened so as to include the larger and even more vital aspects of the subject. There is no reason for delay in meeting this matter in that frank way in which all vital subjects must in the end be met. There is need that the genetic qualities of the parties desiring to join in wedlock

be made the subject of inquiry, and that the genetic values of all people be as an open book to all other people, that some consideration can be given to definite information as to the value of the heredity of each and every person eligible to marriage.

As Prof. R. DeC. Ward of Harvard so clearly showed in his address before the last meeting of the American Breeders Association, we must keep the brothers and sisters of feeble-minded people, as well as those who show feeble-mindedness in their own make-up, from immigrating into our country. The normal brother or sister of a feeble-minded person carries in part of his or her germ plasm the same heredity carrier as do the brothers and sisters in which this character is dominant. And people whose families show that part of their children will be feeble-minded, insane, criminal, or immoral, or in any other way defective, have not the full claim to the rights to produce citizens as have others, none of whose progeny will be a burden upon society.

But withal, this movement must creep before it can walk. The minor things which may be done now are the first tasks at hand, in this as in all the affairs of life. A good woman friend of the Association has called attention to the need of more care in the issuance of marriage certificates. She suggests, and is acting on her own suggestion, that an organization be formed to place in the hands of every prospective groom and bride such specific information as physicians best qualified for the task might impart, in the form of small booklets. The county clerk or other officer could be supplied with copies to be given to all who apply for marriage licenses, and copies could be supplied direct to all young people. These publications could be brief, but should give references to the best available sources of information for further study.

Life insurance companies are beginning to discern the relation of their business to eugenics, and are open to suggestions as to how they can be of service. This applies especially to coöperative insurance companies whose sole interest is the welfare of their members. The members of an association of college women have entered upon a pledge that each member will require any acceptable man who should propose marriage to her, to take out life insurance, in part that there may be a pre-marriage medical examination. Every one of these suggestions, if tried, serves as a means of education, and often results in new information as to what is practicable. When men actually got into the air where they could sense in a practical way the forces they were actually operating, the further invention of the flying

machine went forward apace, and so with eugenics, since society has really entered into the subject, research and practical efforts will go hand in hand to develop the subject rapidly. And certainly one of the first places to work is at the desk of the county official who issues marriage licenses. A system which results in such a large percentage of divorces as the present, certainly needs all the study which modern scientific research can give it, and needs that enterprising means be used in an effort to secure better racial, moral, and economic results.

THESE ARE TIMES OF SCIENTIFIC IDEALS

In bringing the practical breeders together with the scientists there has been created in this Association an atmosphere of enthusiasm and an environment which is fertile with inspiration and which is favorable to maintaining high ideals. The time of aloofness, of the men in rural pursuits, from the larger constructive and coöperative activities of society is coming to an end. The increasing importance of our agriculture in a rapidly growing population and the consequent increasing food consumption, will increasingly bring about the entrance of the more active minds among men from the open country into fields of national activity. The American Breeders Association believes that by offering to the hundreds of thousands of breeders an opportunity to attach themselves to this national Association, which is both scientific and practical, it will do much toward giving their business a meaning, dignity, distinction as well as profit it never had before. It has come to be an honor to belong to this organization and a number of our members carry "MEMBER A. B. A." regularly on their stationery. The efforts of many isolated individuals who are ineffectively scattering their energies, here find those with whom they can coöperate, to lead or to help leaders.

The bringing together in the American Breeders Association of a large number of interested persons has given research in breeding a most wonderful impetus. Through the encouragement of the circuit breeding plan, and other plans on foot, the Association is leading a thorough systematization of the breeding interests. Thus great improvements of our plant and animal resources are being aided to more fully meet the demands of the market requirements in our own country. Breeding in America is being brought to such a point of superiority that this country will reverse its position from an importing country to a successful exporting country of superior breeding stock and fine seeds.

Breeders are coming to look upon their membership in this Association as a professional duty, as does the physician who joins a state or national medical society, or the engineer who takes a membership in the American Society of Mechanical Engineers, or the scientist who maintains membership in the American Association for the Advancement of Science. Its publications have been kept on both a scientific and practical plane, that this Association might become an organization for both scientific men and expert producers.

Here is a word from that veteran breeder of grapes, T. V. Munson, the man who has originated more varieties of grapes than any other man in America, showing the high value he places on his membership in the American Breeders Association: "I regard the American Breeders Association as the most important and influential agricultural association in America, and probably second only to the American Association for the Advancement of Science in promoting general progress and welfare of the nation."

PREACHERS AND EUGENICS

In a recent conference devoted to the betterment of the country church where the discussions had centered about education and religion as the two great agencies of racial advancement, eugenics was suggested as a third agency. The discussion revealed the fact that the preachers of the country are not well abreast of these eugenic times, and there was even a show of aloofness on the part of some preachers. On the other hand, most of these men displayed open minds and were ready to know and eager to seek the newly developed facts and philosophy of this third method of leading to a happy racial status. It was stated that if we could clear the "network of human descent" of its worst dross in the form of feeblemindedness, tendency to immorality, weakness for stealing, and other frailties of genetic origin, that education and religion could make progress in a normal way with the life of each and every individual.

Our preachers need to read of both the results and the technical methods of plant breeding. They should gain a grasp of the philosophy of the animal breeder. And they should delve into the depths of science which Mendel and his followers have built up. They would come more clearly to see that "Nature is God's Unabridged Book," and that it affords standards with which to measure man's works. They would not only be merely earnest and open-minded in their efforts to harmonize the written word and the pages of history in

nature, but they would be more ready to join in nature's evolutionary processes in the betterment of all living things. The well-nigh immortal unit characters give a new racial meaning to the concept of the soul. There is a phase of immortality attached to each Mendelian unit character. Mendel, the abbot, builded better than he knew.

The development of a science of eugenics is placing before preachers as well as before our teachers, physicians, publicists, and other intellectual leaders a new responsibility: The placing of this new phase of our racial life and well-being properly in the minds of the mass of people. Its facts, its warnings, its constructive philosophy, its oncoming practical features, must be made a vital part of the training of every liberally educated person. Our universities and colleges are already beginning to frame up courses in genetics, using facts concerning plant and animal breeding as the groundwork, but strongly developing that division of the subject which relates to the breeding of the human race. Genetic clubs and societies, often called eugenics societies, are being organized at our universities, notably at Cornell and the University of Wisconsin.

No subject brought up for general discussion and solution during recent times is fraught with more possibilities for good or bad than eugenics. Its wrong development might turn the tide against its consideration, or might direct it into lines which would tend to break down morality. Even its becoming a fad as a merely interesting subject is to be feared. It is not the subject for the narrowly housed scientist, nor for the person who wants something interesting as an avocation. It is not to be studied by society people because it affords entertainment, nor is it to be allowed to be "featured" by sensation mongering newspaper reporters. It is rather a subject for the conservators of society, for the practical scientist, the philanthropist, preacher, teacher, editor, father, mother, or other leader.

The facts and principles of eugenics are to become a substantial part of the thought and every-day philosophy not only of educated people but of the masses. And the assistance of all churchmen will be greatly needed to aid in developing the philosophy along wholesome lines, and in carrying to all the people those facts and rules of practice which will best serve the race. When it is realized that it must become almost a racial religion for those with superior heredity to multiply more rapidly, and for those with inferior heredity to multiply less rapidly, in order that the race may evolve upward, a new burden will be placed on the preacher. That the church lay hold of this new agency of eugenic righteousness and place it effectually beside education and religious teaching as the third great agency

for the regeneration of the race, the preachers must study to know the facts, and must be schooled in interpreting the facts of science into the language of the masses. Which universities will be first in offering at least summer courses in eugenics for preachers, Y. M. C. A., Y. W. C. A. workers, and other leaders in religion?

In another place in the *Magazine* is given a list (selected by the Superintendent of the Eugenics Record Office, Mr. H. H. Laughlin) of some of the literature pastors would find helpful in gaining a conception of genetics. That portion of this subject especially relating to eugenics, or the genetic improvement of man, needs wide consideration by many minds that only those things which are wise, practical, and ethical shall be put forward. The preachers are needed in this preliminary development of the subject, that they may assist in giving it an ethical, altruistic, and religious turn.

CHARLES WILLIS WARD, FRIEND OF A. B. A.

The donation by Mr. Ward, of a subscription to *Out Door World and Recreation* to each of the entire membership of the American Breeders Association, was not only a gracious compliment to the members, but it was also a signal service to the Association.

From the very first, in 1904, when Mr. Ward became a life member of the Association, he has shown a deep personal interest in the work of this organization, and a solicitous care in its welfare and has repeatedly extended his help. First by acting as vice-president of the Association in its young days, when counsel and energetic work were most needed; we recall also the generosity with which Mr. Ward defrayed the bill for rent of the hall in which the meetings of the Association were held in 1908 in Washington, D. C.

At that time the Association had not the firm footing it now has. Matters certainly have changed and scientific and other institutions make it a point of honor to place at our disposal their available meeting halls and lecture rooms. These are facts over which the Association has every reason to be exceedingly gratified.

The American Breeders Association has in Mr. Ward a staunch friend and wise counsellor. He is possessed of that spontaneous and earnest enthusiasm which always marks the man of success in business; he has the understanding and vision concerning the work and future of the Association and its place as one of the most important welfare organizations in this country. The vote of appreciation passed by the Association in general session is a well earned tribute to its good friend.

NEWS AND NOTES

EUGENICS AT THE NATIONAL CONFERENCE OF CHARITIES AND CORRECTION

As part of the Thirty-ninth National Conference of Charities and Correction which was held at Cleveland, Ohio, from June 12 to 19, the section on Sex Hygiene held a number of meetings of which one was devoted, exclusively, to the discussion of eugenics.

The presiding officer at this meeting was Mr. Bleecker Van Wagenen of New York who, after speaking briefly on the "Eugenics Program" introduced, in turn, the following speakers: Prof. R. M. Yerkes, Harvard University, who spoke on "Eugenics: Its Scientific Basis and Its Program;" Dr. Henry H. Goddard, Vineland Training School, the topic of whose address was "Marriages of the Unfit;" and Dean Walter T. Sumner, Chicago, who spoke briefly concerning sex problems and eugenics. The paper of Dr. C. B. Davenport of Cold Spring Harbor on "Eugenics and Charity ' was read in his absence. The formal program was followed by a public discussion in which many members of the audience asked questions or spoke concerning phases of the eugenic problem and program which especially interested them.

Chairman Van Wagenen, in his introductory remarks, very clearly and effectively stated the eugenics problem. He produced statistics which served as convincing evidence of the unsatisfactoriness of our racial status, and he thus effectively prepared the way for the speakers who were to follow.

In his address, Professor Yerkes, after sketching the history of the eugenic idea and defining the present eugenic movement, attempted a systematic discussion of the necessary scientific basis of eugenic efforts, and proposed a eugenic program.

He briefly defined eugenics as *systematic endeavor to improve the nature of man*, and proposed, as the chief lines of activity toward this end, *education*, *investigation*, and *legislation*. Education, he emphasized as the necessary condition of profitable investigation and of safe legislation. Of the several directions of educative endeavor, he mentioned especially education (a) concerning the facts and laws of heredity and of their relations to environmental influences; (b) concerning the responsibility of the individual to himself, to his fellows, and to generations yet unborn; (c) concerning the intelligent appreciation of proper, socially and racially profitable marriages;

(d) concerning the intelligent production and up-bringing of children; (e) concerning opportunities to render social service by enlightening one's fellows.

Under legislation, Professor Yerkes proposed that a federal bureau of public welfare be established among the important functions of which should be the encouragement of the scientific study of heredity, the collection of statistics concerning family traits, and the accumulation of such data as should condition wise legislation and eugenic advice.

Dr. Davenport very briefly discussed the dangers of certain kinds of charitable work and contrasted with them the possible benefits of eugenic endeavor. He forcibly pointed out the uncertainty of results in charity, and insisted that our racial problems may be much more rapidly and economically, as well as effectively, solved by striking at the roots of the evils which charity attempts to ameliorate.

In discussing "Marriages of the Unfit," Dr. Goddard described the results of studies concerning the transmission of feeble-mindedness and presented, in some detail, the picture of a family in which two strains appear: the one continuing a family history remarkable for intellectual ability and social serviceableness; the other presenting an appalling array of mental and moral defects.

This family history has been published by the Macmillan Company under the title, "The Kallikak Family."

Dean Summer's remarks concerned the social evil, sex diseases and the urgent need for eugenic enlightenment and action.

The meeting definitely indicated the keen interest of social workers in the possible values of eugenics for the solving of their problems—the problems, namely, of poverty, pauperism, disease, crime, and immorality.

A MINISTER'S LIST OF BOOKS ON EUGENICS AND HEREDITY

This is the list of books referred to in the editorial, page 64. The titles are arranged in the approximate order in which the books are of value to the minister who desires information on the subject of eugenics.

HEREDITY IN RELATION TO EUGENICS. C. B. Davenport. Henry Holt and Company, New York, publishers.

THE KALLIKAK FAMILY. H. H. Goddard. The Macmillan Company, New York, publishers. $1.62.

The Method of Race-Regeneration. Dr. C. W. Saleeby. Moffat, Yard and Company, New York, publishers.

The Problem of Race-Regeneration. Havelock Ellis. Moffat, Yard and Company, New York, publishers.

The Declining Birth Rate. Arthur Newsholme. Moffat, Yard and Company, New York, publishers.

The Social Direction of Human Evolution. W. E. Kellicott. D. Appleton and Company, New York, publishers.

The Human Harvest. David Starr Jordan, American Unitarian Association, Boston, Mass., publishers.

Race Culture or Race Suicide. Robert R. Rentoul. The Walter Scott Publishing Company, London, England.

Heredity. W. E. Castle. D. Appleton and Company, New York, publishers.

Breeding and the Mendelian Discovery. A. D. Darbishire. Cassell and Company, New York, publishers.

Heredity and Society. William C. D. Whetham. Longmans, Green and Company, London, England, publishers.

Biological Aspects of Human Problems. Christian A. Herter. The Macmillan Company, New York, publishers.

Heredity and Social Progress. Simon N. Patten. The Macmillan Company, New York, publishers.

The Coming Generation. William B. Forbush. D. Appleton and Company, New York, publishers.

ORGANIZATION OF A EUGENICS SOCIETY IN UTAH

Through the instrumentality and under the leadership chiefly of members of the American Breeders Association, a State Eugenics Society was organized at Salt Lake City, Utah, during the latter part of May of this year. We wish the Utah contingent abundant success in their venture which, as stated by their spokesmen and women, "is more for the purpose of studying eugenics than with an active propaganda in view." The news of this move has been received differently in different quarters. Thus for instance, the editor of the *Utah Republican* remarked at the time of organization. "That the wisdom of the course of organizing for the purpose of study, rather than active propaganda, is manifest. Great reforms are always possible up to the point where they challenge human nature" and concludes: "where the applied science of eugenics seeks to work through man-made laws it will meet its Waterloo." He evidently thinks that the study of this subject is an entirely harmless diversion, and that the use of the knowledge obtained by research to enlighten mankind is impossible.

We trust the Utah Eugenics Society will be held closely to its purpose by the scientific men responsible for its organization and that

it will become an active and working body and will make use of the abundant research material available in the race conglomerate of Indians, half breeds, orientals and especially the old Mormon families of whom no doubt church and other records exist reaching far back.

ELIMINATION IN THE THIRD GENERATION FROM A CROSS

When one has made a wide cross between strains of ornamental plants (for instance, cannas), it is not difficult to pick out the required types from the first or second generation, by simple inspection. For these strains of plants being grown only for show, good looks are the most important requirement. But when one is working with field crops, fruitfulness and vigorous growth come first; and appearances are only considered secondarily, or not at all. In scientific breeding, after the second generation has been grown, and all possible eliminations have been made from it by inspection, the remaining strains may be tested for vigor and productivity by sowing about a hundred seeds of each, and crowding them among another crop, so that only a small percentage will survive. Those families whose survivors yield the greatest crop, in spite of the crowding, will show, by the survival of the strongest, that they are in this respect well adapted as forage plants for field culture. (For, even with corn, the greatest crop on a given acreage can only be had by crowding the stalks more closely than would be indicated by the conditions for the best individual yield. And the same is the case with most other field or forage crops.) Such an automatic selection of the many undetermined characters which combine to produce a good yield, will often be a quicker and cheaper method than trusting to the eye alone as a means of selection and elimination.

The Velvet and Lyon beans are grown in Florida as forage crops. The fields have to be kept clear of weeds at first; but when the vines have spread between the rows so that cultivation ceases, their growth is usually sufficient to stifle the weeds. Hence the first recommendation for a new bean of this type is a superior ability to choke down weeds. From the second generation of the cross between the Velvet and Lyon beans, grown in hills 8 feet apart, 82 individuals were selected, and their seeds sown in an elimination field, for the third generation. Along with them were sown, for comparison, pure lines of the Velvet and Lyon beans. The elimination field was set out with lines of sorghum 8 feet apart, the sorghum being sown thickly as if for silage. When the sorghum had sprouted, 100 seeds (in most cases)

of each of these second-generation plants were dibbled by hand in the rows of sorghum, 2 inches deep and 4 feet apart. When the young plants came up, they had to struggle with the sorghum; and, out of 6093 seeds, only 740 produced plants that bore pods. The amount of the crop produced by each family under these circumstances was a valuable guide to the properties of that strain; for, although most (or all) of the parents were heterozygous in some points, yet, as is usual in self-fertilized plants, the majority of their offspring resembled the parent in somatic characters. The further growth of strains which headed the list, or were low down in it, justified the placing of some confidence in the results of the elimination. The more factors in which the original parents differ, the more useful will probably be the elimination test.— John Belling, *Gainesville, Florida.*

A FARM FOR BREEDING MEDICINAL PLANTS

What might be called a private experiment station for plant breeding is being developed in connection with the scientific departments of the Eli Lilly Company, pharmaceutical chemists, Indianapolis, Indiana. The investigations being carried on at these laboratories suggest an entirely new field in plant breeding. Valuable medicinal plants are being introduced from other countries and their improvement attempted through the application of the best methods of plant breeding. Selections based upon chemical assay and physiological tests are being carried out on many individual plants of *belladonna*, *henbane*, *stramonium*, *digitalis* and others. Variety tests are also performed in the open field, and such conditions as the influence of relative yield, curing properties, harvesting of roots, leaves, etc., are subjects of investigation. The work is conducted by the Botanical Department of the Eli Lilly Company (member A.B.A.), which has greenhouses, an experiment farm, and all necessary laboratory equipment for carrying on such work. Mr. Frank Miller is in charge of the plant breeding work.

THE ARNAUD SHEEP-GOAT HYBRID

The accompanying illustrations represent a peculiar case of a hybrid resulting from a sheep-goat cross. Figure 1 shows the hybrid and Figure 2 its twin, which is not a hybrid. Figure 3 shows the dam, figure 4 the sire of the sheep-goat hybrid, and figure 5 the sire of the lamb that was born a twin to the hybrid.

This hybrid was produced on the farm of Mr. E. Arnaud a few miles south of Monet, Mo. The writer has seen the animal since its

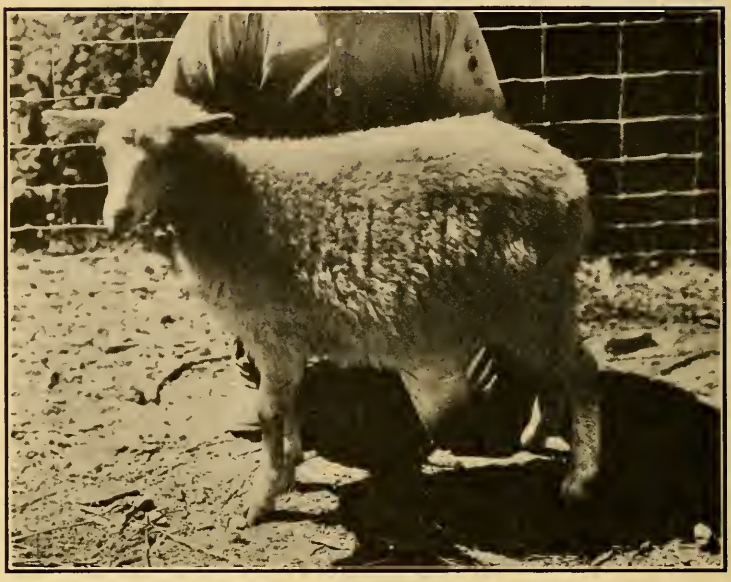


FIG. 1—HYBRID OF SHEEP-GOAT CROSS.

FIG. 2—THE TWIN OF THE SHEEP-GOAT HYBRID SHOWN IN FIGURE 1.

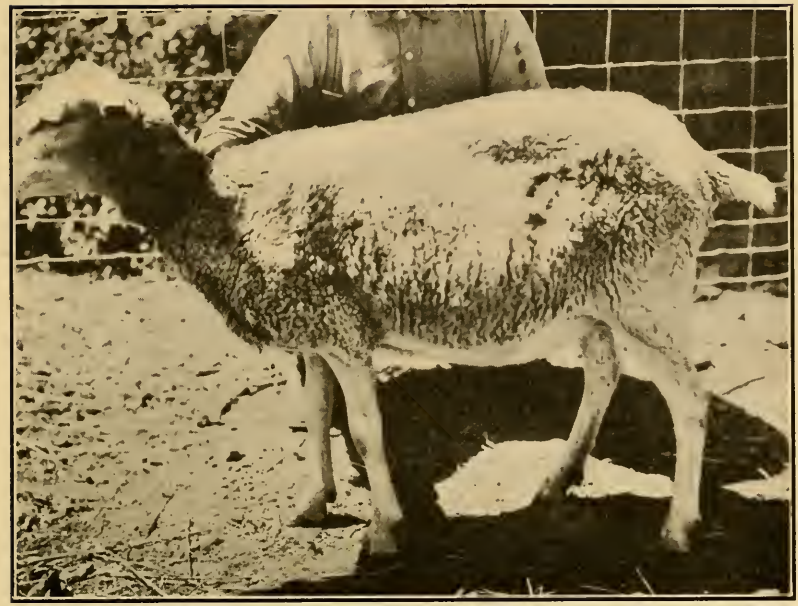


Fig. 3—Dam of Sheep-Goat Hybrid and its Twin.

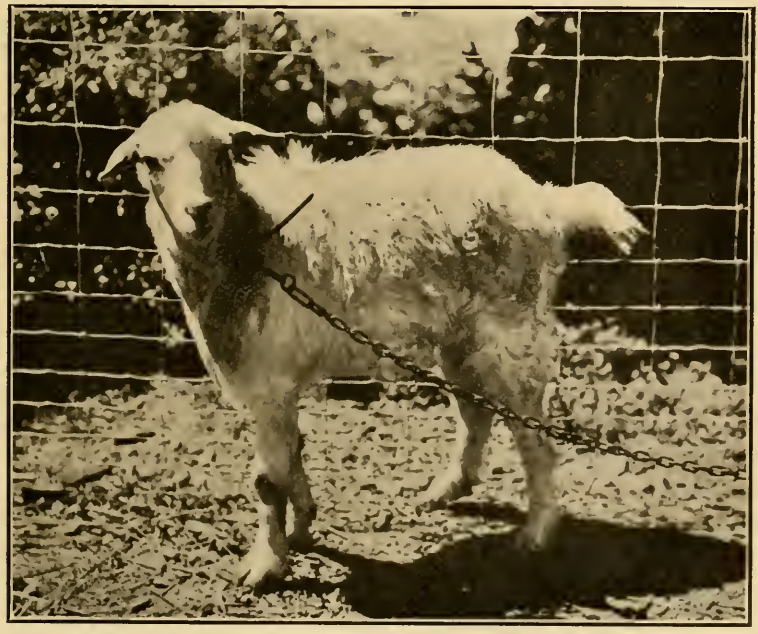


Fig. 4—Sire of Sheep-Goat Hybrid.

maturity, and finds that its body is generally covered with goat hair but it has also a small shaggy growth of sheep's wool, especially on the back. This hybrid is a female and appears to be infertile, but not absolutely so for it has once produced a half grown foetus.

The only other sheep-goat hybrids of which the writer has been informed are four produced on the ranch of Mr. C. J. Jones ("Buffalo" Jones), of New Mexico, who states that all four of these hybrids are females. This is of interest in connection with the fact that nearly

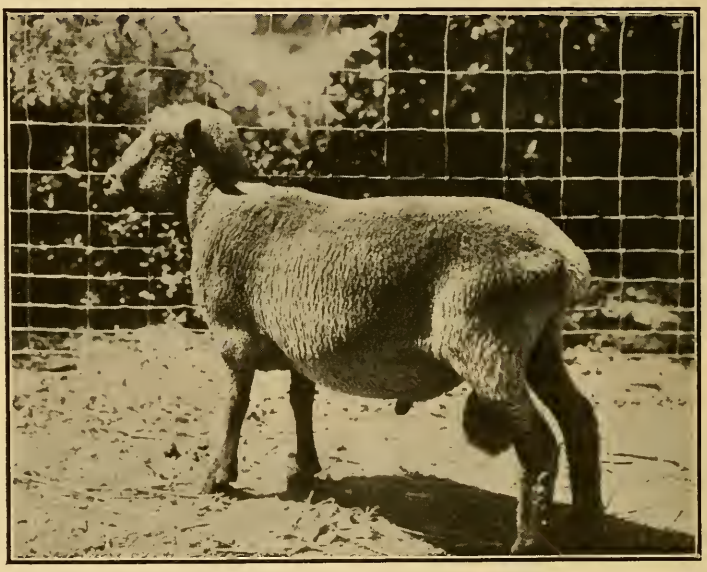


FIG. 5—SIRE OF THE LAMB, TWIN TO THE HYBRID.

all the hybrids between buffaloes and cattle that have been produced in this country have been females.—W. J. SPILLMAN, *Washington, D. C.*

MENDEL JOURNAL DISCONTINUES

The *Mendel Journal* announces in its September, 1912, issue "That no further numbers of the *Mendel Journal* will be published." The suspension of this publication is greatly to be regretted, whatever may have been the reasons for this step. The *Journal* covered the entire field of general genetics literature, and was always interesting and readable.

BLACK FOX BREEDING

At the Annual Meeting of the Association a year ago, I gave a brief account of the beginning of the black fox business on P. E. Island. Some of the members of the Association were somewhat startled at the unusual prices obtained for live foxes for breeding purposes and thought prices must certainly come down. But the tendency has since been an upward one. In fact, prices are almost double what they were a year ago.

European capitalists are getting interested in this business and six pairs of foxes have been sold to a concern in Russia for $100,000 to be delivered next year. It is apparent that the fox business is yet in its infancy in this country and that the demand for valuable furs will steadily increase. The price of breeding animals is so large now that only an individual here and there can reach it, and as a consequence companies are being formed for the purpose of breeding foxes on a commercial scale. But there is a warning to be sounded. Many are losing sight of the fact that it is only the very best individuals that bring the high prices for their fur and in their haste to get foxes to breed many purchasers are getting a class of stock that will not produce high priced fur. I think that after while, much more attention will be given to this and the quality of the fur will be the first consideration.—B. I. Rayner, *Alberton, P. E. Island, Canada.*

A CORRECTION

Members are requested to make the following corrections in their copies of the Annual Report, No. VIII.

Page 573, Cut Fig. 3 should appear over legend to Fig. 7.

Page 576, Cut Fig. 7 should be over legend to Fig. 8.

Page 576, Cut Fig. 8 should be over legend to Fig. 3.

PUBLICATIONS RECEIVED

The Primary Color-Factors of Lychnis and Color-Inhibitors of Papaver Rhoeas. George Harrison Shull, Reprint from the *Botanical Gazette* vol. liv. August, 1912.

From Dr. George Harrison Shull, Cold Spring Harbor, Long Island, N. Y., also the following publications:

Experiments with Maize. Reprinted from the *Botanical Gazette*, 52, December, 1912. Pp. 480–485.

A Pilgrimage to Brunn. Reprinted from the *Antiochian*, vol. 2, June, 1912.

Hermaphrodite Females in Lychnis Dioica. Reprinted from *Science*, no 928, October, 1912. Pp. 842–843.

"GENES" OR "GENS?" Reprinted from *Science*, N. Y., no. 908, May 24, 1912. Pp. 819.

"GENOTYPES," "BIOTYPES," "PURE LINES," AND "CLONES." Reprinted from *Science*, N. Y., no. 888, January 5, 1912. Pp. 27-29.

INHERITANCE OF THE HEPTANDRA-FORM OF DIGITALIS PURPOSEA L. Reprinted from *Zeitschrift fur Inductive Abstammungs and Vererbungslehre*. 1912. Bd. vi. Heft 5.

JOURNAL OF GENETICS, vol. 2, no. 3, November 1912. Contents:

L. DONCASTER, "The Chromosomes in the Oogensis and Spermatogenesis of *Pieris brassicae*, and in the Oogenesis of *Abraxas grassulariata*;" CLIFFORD DOBILL, Some Recent Work in Mutation in Microorganism;" R. C. PUNNETT, "Inheritance of Coat Color in Rabbits;" A. H. TROW, "On the Inheritance of Certain Characters in the Common Groundsel;" FREDERICK KEEBLE AND E. FRANKLAND ARMSTRONG, "The Role of Oxydases in the Formation of the Anthocyan Pigments of Plants."

FURTHER CONTRIBUTION TO THE STUDY OF THE INHERITANCE OF HOARINESS IN STOCKS (MATTHIOLA). Edith E. Saunders. Reprinted from the *Proceedings of the Royal Society*, B, vol. 85, 1912.

ON THE RELATION OF LIMANIA ALPINE TYPE TO ITS VARIETIES CONCOLOR AND ROSEA. Edith R. Saunders. Reprinted from the *New Phytologist*. June 1912. Pp. 167-169.

NEW BOOKS

PROFITABLE BREEDS OF POULTRY. Arthur S. Wheeler. The Outing Publishing Company, publishers, New York, 1912. Pp. 134. Price, 70 cents net.

A useful and helpful book for the beginner or novice who is making an unprejudice study of breeds preparatory to going into the business, either as source of profit or as a hobby. This booklet does not undertake to describe all existing breeds of poultry, but confines itself to a few breeds which in the opinion of the author are the profitable breeds. Separate chapters are devoted to the Orpingtons, Rhode Island Reds, Mediterraneans and Cornish. These chapters contain besides descriptions and historical references, observations on the breeding and mating of the fowls for best results. Now and then is thrown in, a bit of breeding philosophy. Thus the author opines that: "The man who squats for an hour in a henhouse on a cold winter day, to study the points of his breeding birds, may arouse the beholder's sense of humor, but he is the fellow who will get from his matings, offspring, 10 per cent better than the parents and consequently more profitable. . . . Crossing, except by way of experiment, is poor policy." "A single variety is enough for the average plant."

There is a brief chapter on the keeping, management and housing of poultry and some very good general advice. Certain remarks

on the business and financial side of the poultry business are worth taking to heart. The author has this to say: "I doubt if a man of small capital ought to take up poultry with an idea of making money, unless he has a genuine love for birds." And closes the book with this warning: "One merely grins when a man of means rises to a gaudy bait, but I have known poor men and women who risked, and lost, money they could ill afford, under the delusion that eggs from the pen of Gimcrack II, the sure sire of winners, would put them in the way of astounding the local bank. Viewed sanely, it is either a pleasure-giving avocation, or a handy method of deriving generous interest from an investment of money, skill and persistent and sympathetic labor."

False Modesty. Dr. E. B. Lowry. Forbes and Company, publishers, Chicago, 1912. Pp. 110.

The author is doing the world of men and women a real service by the publication of her series of books on personal purity and on matters pertaining to sex. In this booklet, which can be read in an hours' time, it is shown that society at large is countenancing certain ideas of modesty, which are not only totally false, but which are responsible for untold harm, causing misery, destruction of health, honor and life. The booklet is an appeal not only to fathers and mothers but to all who may have children in their charge, to break the conventional conspiracy of ignoring silence.

This modest and sensible little booklet has condensed in its eight chapters, the wisdom which has been gathered in a wide and varied medical experience of years and every word of it is worth reading. The false modesty and smugness with which society is stupidly covering up it vices, sins and shortcomings is scored and the need of instructing our boys and girls concerning sex hygiene is supported by unanswerable argument. Dr. Lowry outlines an aggressive program in educational reform and suggests that the womens clubs, ladies aid and home missionary societies, which when we come to analyze it are the initiators of practically all reforms, take up the subject of sex hygiene and of educating parents to the immense importance of taking a correct and sensible view of those matters, so that in turn these parents may instruct their sons and daughters. According to the author there is greater need of this form of instruction in the country districts than in cities.

False Modesty is a good book to place in public libraries. On account of its low price it should be possible for social reform societies

and clubs to purchase and distribute it in large numbers among persons who may be benefited by its advice and help.

REFERENCES IN CURRENT LITERATURE

A NEW SUBSPECIES OF ZEA MAIS L. Dr. Walter B. Gernert, University of Illinois. Reprinted from the *American Naturalist*, October, 1912.

The author describes a new type of corn which originated on the Experiment Station Farm at Urbana, Illinois, in 1909 apparently by mutation, from a strain which has for a number of years been selected for high protein content. The new type is characterized by a broadly conical ear, which has, in place of a cob, an inner central stem which bears numerous irregular branches which bear the kernels. The name *Zea ramosa* has been proposed as a specific name, justified by the species named by Sturtevant, as indentata, tunicata, evepta, indurata, etc.

The heredity of this new corn is fairly established, breeding true to type. The ears are true female organs and not merely modified male florets such as are occasionally found as sports. Observations are being made as to the possible economic value of this strain of corn; at present its yield is less than of common corns but could perhaps be increased by selection or hybridizing. It is thought, that being practically without cob it might be a good feeding or ensilage corn. Further breeding and tests are being made to determine its agricultural value.

THE CHURCH'S STAND FOR PURITY. *Literary Digest*, June 29, 1910.

Review of journalistic and press comment on the recent action of the Very Rev. W. T. Sumner, Dean of the Episcopal Cathedral in Chicago, requiring presentation of a satisfactory medical certificate from persons presenting themselves for marriage. The *Litery Digest* reviews the situation with its usual aptitude and sums the matter up in the following:

General, though not unanimous, approval greeted the refusal of the Protestant Episcopal Cathedral clergy in Chicago to marry any person without a physician's certificate of freedom from incurable or communicable disease . . . . All the physicians quoted in *The Medical Times* commend Dean Sumner's plan. Some of them urge legislation making the possession of such certificate a prerequisite to marriage. Among the ministers, there is a universal desire to prevent the marriage of the unfit, but some disagreement as to the methods. The Chicago plan is heartily indorsed by the Rt. Rev. Samuel Fallows, presiding bishop of the Reformed Episcopal Church, Rev. John Haynes Holmes

of New York, Rev. Charles H. Parkhurst, President Emeritus Tucker of Dartmouth, Rev. G. C. Peck of New York, Rev. Russell H. Conwell of Philadelphia, and President McMaster of Mt. Union College. Others, like Bishop Anderson and McConnell of the Methodist Episcopal Church, Bishop Williams of the Protestant Episcopal diocese of Michigan, and Bishop Niles of New Hampshire, while expressing sympathy with the general movement, give the action of the Chicago Cathedral clergy a more qualified approval. Rabbi Joseph Silverman of New York favors the advisability of a compulsory health certificate, and the Rev. Henry M. Sanders of New York, who doubts "whether the Church can wisely do more than exert its influence in that direction by means of education," thinks that, as marriage is a civil contract, "the State can better exercise this supervision, under the direction of the medical profession, than the Church."

The magazine editor has closely followed the comment on this matter made by publicists, divines, physicians and editorial writers in all sections of the country, and concludes that the proposition has been favorably received and practically without a voice in opposition. Several question whether such rules can be enforced even if generally adopted and that the regulations, or even law, "would be craftily and incessantly violated, in view of the common disrespect for law and order," and thus work hardship upon those who placed too full trust in the regulations. Several divines express the fear that such regulations, strictly enforced, might drive marriage from the church to the civil authorities. But neither of these contingencies are likely to arise. The medical profession may safely be depended upon to check quickly disreputable practices which might arise in the issuance of certificates of physical soundness. On the other hand, those whom the church for cause refuses to marry, would by going to the civil officer, soon cause this class of marriage institution to exercise discretion, as the state could not afford to allow its institutions to fall into disrepute.

The unexpected action of Dr. Sumner has broken the ice so far as coöperation of the church with other social agencies is concerned. He has placed the matter before a constituency which heretofore has had no particular viewpoint on eugenics, and he has very definitely pointed out the direction in which the church can make its contribution to voluntary negative eugenics, all without agitation and without legislation. The American Breeders Association invites all clergymen to become members of this organization, both that they may keep abreast of the latest thought, and that they may coöperate in pushing forward the good work the Association has started.

ASSOCIATION MATTERS

ELECTION OF LIFE MEMBERS DURING THE FOURTH QUARTER 1912.

Mr. J. Lawrence Hamilton, Brighton, England; Mr. V. Culberson, Fierro, New Mexico; Dr. F. R. Harris, Henderson, North Carolina; Mr. Pandurang Khan Khoje, Pullman, Washington; Mr. Wm. C Sharbrough, Holly Bluff, Mississippi; Mr. W. Atlee Burpee, Philadelphia, Pennsylvania; Dr. Vaseelie Yurieff, Kharkow, Russia; Miss Sybil Hyatt, Kinston, North Carolina.

A NEW A. B. A. CIRCULAR

The office of the secretary of the Association has lately gotten out a 17-page circular, designed for use in interesting persons in the work of the Eugenics Section and getting new members for the Association. The title, "Eugenics and the General Genetics Movement" explains its contents, which consist of a condensed statement concerning the organization, work and purposes of the American Breeders Association with special reference to its Eugenics Section, and the bearing of Eugenics on society and on various lines of human thought and activity. This circular, which is designated Circular No. 1, will be mailed to all persons who make request for it, and also to all persons whose names are sent in by members and who might be induced to take membership.

A SPECIAL PRIVILEGE TO MEMBERS

Mr. Charles W. Ward, a Life Member of the American Breeders Association and widely known as a breeder of carnations and peonies, a nature lover and owner and editor of the *Out Door World and Recreation Magazine*, has made a splendid present to the American Breeders Association and authorizes the secretary to announce that every new and paid-up American member of the Association will receive a complimentary subscription to *Out Door World and Recreation* during the year 1913. This places no member of the Association under any obligations whatsoever, as all will receive *Out Door World and Recreation* as a part of their membership privilege, same as they receive the *American Breeders Magazine* and the *Annual Report A. B. A.*

Members, who are in arrears for 1911 and 1912 and who wish to benefit from this offer, must pay up their dues to date.

Out Door World and Recreation is a high class, elegantly illustrated magazine; the lover of nature, and lover of wild plant and animal life cannot fail to appreciate it. It is not merely a magazine for entertainment, but it stands for a cause and seeks to accomplish something. Mr. Ward has recently perfected a deal whereby a large island off the coast of Louisiana has been permanently set aside as a refuge station for migratory birds.

Foreign members of the Association may avail themselves of this offer by remitting to this office the amount of the postage which is 65 cents per year to Canada and 75 cents to all other foreign countries.

THE AMERICAN BREEDERS ASSOCIATION AND THE NATIONAL CORN EXPOSITION

The National Corn Exposition typifies splendidly the new spirit of education in agriculture. It is an agricultural winter fair, the only one in the United States, and governed by men who have the upbuilding of American agriculture at heart.

The American Breeders Association, itself a public welfare organization, recognizing the value and influence of the National Corn Exposition has at different times so arranged that its annual meetings were held in connection with the Exposition, benefiting by such an arrangement.

This year again, the A. B. A. held its meeting as the guest of the National Corn Exposition and it is again met by the same cordiality, the same generousness, and helpfulness as in other years. The Exposition authorities have, as heretofore, done everything so far as was in their power, to make the meeting of the A. B. A. a success. The American Breeders Association has in the National Corn Exposition a most staunch friend; it has always been a pleasure to coöperate with its officials and we trust that the individual members of our association will use every opportunity to promote these cordial relations and to help build up the Exposition into the great national agricultural fair needed to inspire the American farmers to greater excellence in production of farm commodities, in education, in rural, social and civic life, and in a genetically better race of people.

ADVERTISING IN THE MAGAZINE

Beginning with January, 1913, the *American Breeders Magazine* will open its pages to general advertising. This step has been taken by the Council after thorough consideration of the case. The grow-

ing membership of the Association and the outstanding high character of its annual membership, life membership and other readers of its publications make the pages of the *Magazine* a valuable business asset to the Association, too valuable not to be used. Before now, repeated requests for the purchase of space had been turned down as the postal laws made it impracticable for the Association to solicit advertising. The passage by Congress of the Act of August 24, 1912, cleared and simplified the situation and the Association is now in position to utilize this asset.

A contract has been entered into with an advertising firm, which has a plan of handling the advertising of a group of scientific journals, whose combined circulation gives advertising business houses a guarantee that their advertisements will be read by a wide and a most desirable constituency, or in other words high class readers—people with a wide range of wants, and the means to purchase what they need and want.

Members are requested to assist in building up this department of the *Magazine*; they have the assurance of the editors of the Association that the reading matter will not be curtailed, and that advertising will appear in additional pages. Any earnings which may arise from this department will be devoted to the improvement of the *Magazine*.

WHO HAS THEM

The Library of the R. I. Agricultural Experiment Station, Kingston, R. I., desires to obtain volumes I and II of the Annual Reports A. B. A., and has for disposal volume III of the same.

Members of the Association who have these publications to sell or exchange will kindly communicate with the librarian of the Experiment Station.

THE AMERICAN BREEDERS MAGAZINE

ORGAN OF THE AMERICAN BREEDERS ASSOCIATION

Vol. IV Second Quarter, 1913 No. 2

Announcement

Since the last issue of this magazine, the American Breeders Association has undergone a complete reorganization, due to the retirement from public life of the Hon. James Wilson, its honorary president, and the resignation of the Hon. Willet M. Hays, secretary-treasurer, and of George W. Knorr, editorial secretary. To increase its efficiency, the association has incorporated under the laws of the District of Columbia. A report of the reorganization and a list of the new officers will be found elsewhere in this number.

These changes have resulted in new plans for the organ of the association, THE AMERICAN BREEDERS MAGAZINE. The desire of the new management is, briefly: to retain the high standard of scientific accuracy which has made the magazine valued in the past, but at the same time to present articles of such a nature, and so well illustrated, that they will interest not only those working in the particular field of which the article treats, but all who desire to keep informed in an authoritative way of progress made in plant and animal breeding and eugenics.

In the future the magazine will be issued monthly. The numbers appearing in October, November and December of this year will complete the current volume, number four. Beginning with volume five in January, the magazine will be increased in size. Members of the association understand that the magazine is published solely for their benefit, that it is not a money-making institution, but that all profit from it will be devoted to the improvement of the magazine or, eventually, to the promotion of research in certain lines that are neglected because they do not offer immediate commercial results.

At present, however, the magazine is not even self-sustaining. Its continued publication has been made possible only by the generous support of a number of members who have pledged a guarantee fund to meet possible deficits during the first few years. In order that all members may derive the greatest possible benefit from it, the magazine must be made financially profitable, through an increase in membership of the association. To put the finances on a sounder basis, it has been found necessary to discontinue the publication of the annual report, and material which formerly was printed in this will hereafter be included in the monthly magazine.

To bring about the fullest measure of co-operation between the nearly 2000 students of genetics who make up the American Breeders Association, it is therefore first of all necessary that the membership should be increased, and every member is asked to feel a personal responsibility in this matter, not only in the interests of the science of genetics, but in his own interests as a student of that science and a member of this association. In the second place, members of the association are urged to use its magazine as a channel for the publication of results of their work in plant and animal breeding and eugenics.

The original purpose and chief work of the association is to secure an interchange of ideas between workers on different aspects of heredity and environment. If it is to serve this purpose through its magazine, articles printed in the latter must be of a popular character; that is, an article on plant breeding, for example, must not be unintelligible to the student of eugenics, or vice versa. This does not mean that technical terms may not be used nor technical questions discussed. As long as the treatment of such matters can be kept in the plane of intelligibility to the general scientific reader, such papers will be especially welcome. Perhaps the best way of making a technical article intelligible and interesting to one who is not a specialist is by the use of photographs, and writers are particularly urged to pay attention to this feature; the magazine will co-operate with them to the extent of its financial ability, in properly illustrating their articles. But in order to make the developments of genetics accessible to as large a circle of readers as possible, it wishes strongly to urge its contributors to avoid too narrow a technical view of their subjects, and to emphasize as far as possible the broad principles underlying their work. To the limit of its ability to discriminate, the council of the association will avoid

the publication of any material which is not of a scientific nature, in the deepest sense of the word.

In its endeavor to make the American Breeders Association advance the interests of science, the council hopes for the co-operation of everyone interested in the most important branch of science—that which deals with the production of better plants, animals and men.

New Citrous Fruits

Successful Hybrids—The Citrange, Tangelo and Limquat—Cold-Resistant Substitutes for the Lemon and Lime—Future Possibilities*

Walter T. Swingle,

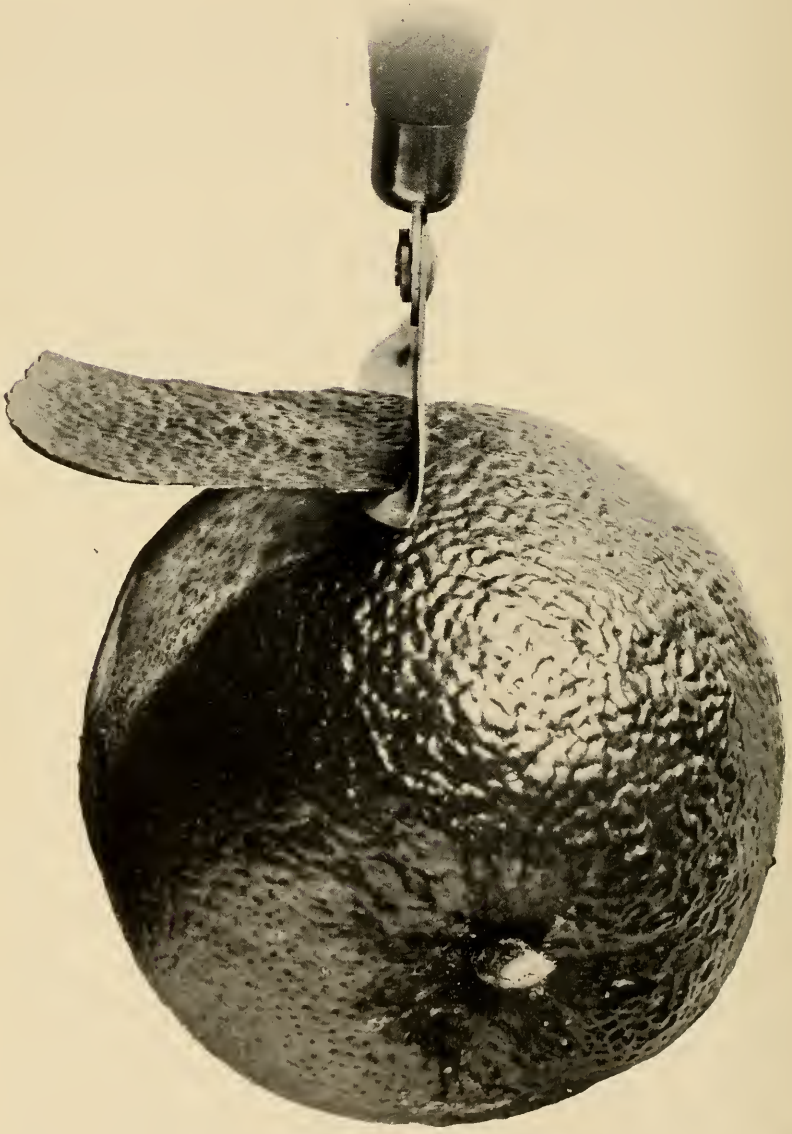
Physiologist in Charge, Crop Physiology and Breeding Investigations, Bureau of Plant Industry, Washington, D. C.

In the spring of 1910, I presented to the horticultural societies of Alabama and Florida, two papers on the breeding of new types of citrous fruits. As these papers were published in the proceedings of those horticultural societies[1] [2] it is not necessary for me to rehearse here the accounts published there in full. For the benefit of those who have not followed the work I may state that citrous breeding work was begun by me in Florida in 1893, but that the hybrids made at that time were for the most part lost during the great freeze of the winter of 1895-6; that the most important work was that carried on in the spring of 1897 when I made a determined effort to originate hardy citrous fruits by crossing the common oranges with the hardy Chinese *Citrus trifoliata*. In all 212 crosses were made, of which one parent was *Citrus trifoliata*. Three fruits were secured which yielded altogether 13 true hybrids. When these fruited they turned out to be a new type of citrous fruit, so different from any then existing as to require a new name and they were

* Read before the American Breeders Association, Ninth Annual Meeting, Columbia, South Carolina, Jan. 25, 1913.

[1] Swingle, Walter T., 1910, New types of Citrus Fruits for Florida (read May 18, 1910), in Proceed. 23 Ann. Meet. Florida State Hort. Soc., Ormond, Fla., pp. 36-41, pls. 1-8.

[2] Swingle, Walter T., 1910, New Methods of Breeding and Testing Hardy Citrous Fruits (read Jan. 28, 1910), in Rept. 7 Ann. Meet. Alabama State Hort. Soc., Bessemer, Ala., in Bull. State Dept. Agric., Serial No. 36, pp. 190-200.



MORTON CITRANGE, NATURAL SIZE.

A remarkable hybrid between the Japanese orange, hardy as far north as Washington, and the ordinary orange. To avoid the strong oil in its glands, the skin should be peeled before cutting the fruit. (Plate 1.)

accordingly called "Citranges" by Dr. H. J. Webber and myself.* Citranges vary greatly in size, shape and color, but are all alike in having very abundant acid juice of an aromatic and slightly bitterish taste. A very good substitute for lemonade can be made from them and they can also be used for culinary purposes. Citranges are admirably adapted for home use throughout most portions of the Cotton Belt, where the climate is far too cold for growing ordinary citrous fruits.

The best citranges thus far produced are undoubtedly the Morton, Colman, Savage, Rusk and Cunningham. The first three named are large fruits, the largest being the Morton, which frequently exceeds a pound in weight (Pl. I). It is nearly round and closely resembles a large orange. It may be served as a breakfast fruit if plentifully sprinkled with sugar. The Colman, on the contrary, is somewhat flattened and can be distinguished at once by its mottled yellow skin which is covered with a fine fuzz. The peel of this citrange does not contain the disagreeable oil common to the others (Pl. II). The only other citrange having fuzzy skin is the Cunningham, which is a small fruit resembling a miniature Colman. The Savage has the external appearance of an orange except that it is slightly flattened and exhibits a tendency to ribbing. It is considerably smaller than the Morton. The Rusk is the smallest of the citranges, eight average size fruits going into a quart measure. The tree itself is an ornament, being loaded with white blooms in Spring and with brilliant red fruits in Fall (Pl. V). It is the most prolific of all and the most precocious, frequently bearing the third year after budding.

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* These citranges have been described in the following papers:

Swingle, Walter T., and Webber, Herbert J., 1898, Hybrids and Their Utilization in Plant Breeding, in Yearbook Dept. Agric. for 1897, p. 415, fig. 13.

Webber, Herbert J., 1900, Work of the United States Department of Agriculture on Plant Hybridization, in Journal Royal Hort. Soc., London, 24: 128-138, 144, figs. 42-47. Also reprinted separately, pp. 1-11, 17, figs. 1-6.

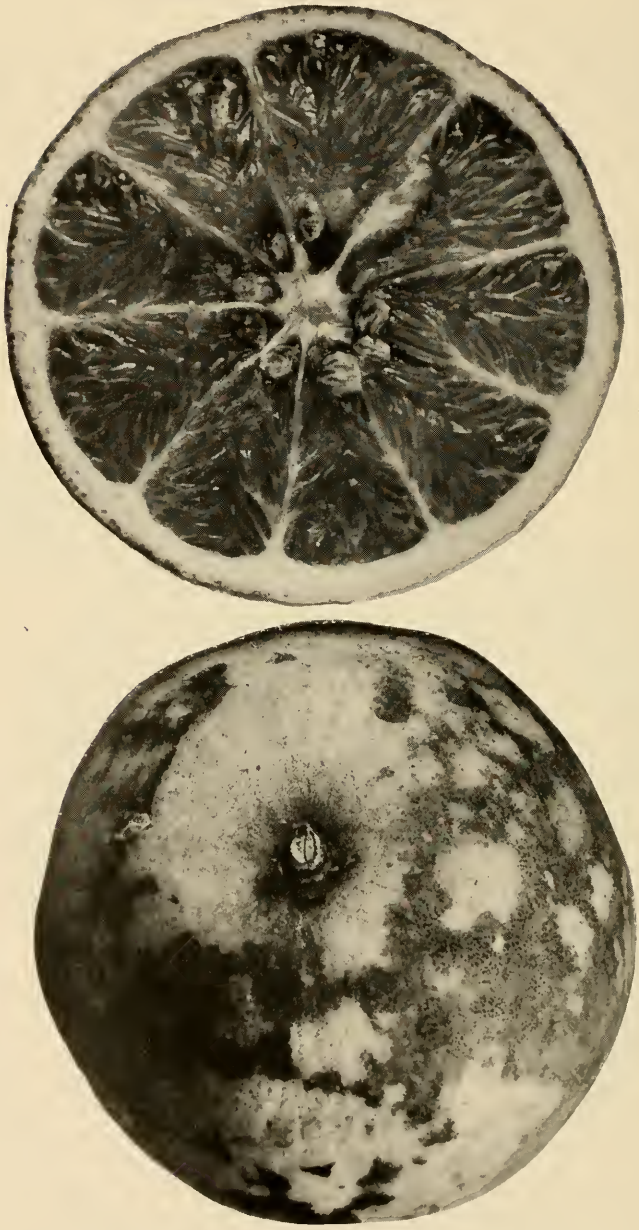
Webber, Herbert J., and Swingle, Walter T., 1905, New Citrus Creations of the Department of Agriculture, in Yearbook Dept. Agric. for 1904, pp. 221-235, figs. 12-13, pls. 10-16.

Webber, Herbert J., 1906, New Fruit Productions of the Department of Agriculture, in Yearbook Dept. Agric. for 1906, pp. 275-278, fig. 80, pls. 17-19.

Webber, Herbert J., 1907, New Citrus and Pineapple Productions of the Department of Agriculture, in Yearbook Dept. Agric. for 1906, pp. 329-336, fig. 10, pls. 17-20.

Webber, Herbert J., 1912. Citrus-Arten, in Fruhwirt, D. C., Die Züchtung der landwirtschaftlichen Kulturpflanzen, 5: 107-121, figs. 18-24.

Swingle, Walter T., 1910-1913. See the articles cited elsewhere in this paper.



COLMAN CITRANGE.

This variety, shown natural size, is conspicuous by the dark blotches which are always present, and due to fungus growth among the fuzzy hairs covering the skin. Oil glands small and few. (Plate 2.)

The fruits of the Willits citrange exhibit a tendency to freakishness in shape, becoming sometime a mass of finger-like segments (Pl. III, IV). When of normal shape the fruits of this variety yield an abundance of juice of excellent quality. The Saunders citrange, though small in size and having a very rough thick skin, is of interest because of its good keeping quality (Pl. V).

The surprising variations exhibited by these citranges led to a renewed study of the phenomena of inheritance they manifest and in the autumn of 1911 I read a paper at the Fourth International Conference on Genetics at Paris, calling attention to the impossibility of accounting for observed variations by the ordinary laws of heredity and suggesting a new principle, Zygotaxis,* presumably of wide application in the explanation of these facts. I need not discuss this phase of the matter here. Suffice it to say that the wide variations exhibited by sister citranges of identical parentage showed the desirability of producing these hybrids in large numbers in the hope of occasionally securing an exceptionally valuable combination of characters. Accordingly, beginning in 1909, I again undertook the breeding of hardy citrous fruits on a very large scale and as a result some thousands of hybrids, containing more or less blood of the *Citrus trifoliata,* are now growing in various parts of the South.

At the same time that the original citranges were made in the spring of 1897 another hybrid was made between the tangerine orange and the grapefruit. The resulting fruit was also of a new type and was named "Tangelo." The first of these tangelos, which received the varietal name of "Sampson," has since come to be cultivated commercially on a small scale in several parts of Florida. It has developed in the course of this work that the tangelos show amost as much variation as do citranges and are almost as much unlike the parent species. Tangelos show little of the grapefruit and almost nothing of the tangerine, but are in effect new types of oranges showing a greater variability as to size and color and having, as a rule, a more sprightly flavor, in this respect approaching somewhat to the grapefruit. There can be no doubt that these hybrids called tangelos constitute an important source of new and improved citrous fruits for commercial

* Swingle, Walter T., 1913. Variation in First Generation Hybrids (Imperfect Dominance); its Possible Explanation through Zygotaxis, read Sep. 23, 1911, in Comptes Rendus de la 4ième Conférence Internationale de Génétique, Paris. p. 381-394.

ABNORMAL WILLITS CITRANGES.

Cross sections, slightly less than natural size, of some of the abnormal types, which are of good flavor although of fantastic appearance. Produced particularly while the tree is young. (Plate 3.)

culture. Realizing this fact, I have for the past three years carried on extensive hybridization work in Florida with the help of F. W. Savage, and some thousands of new types of tangelos are now being propagated.

Another new type of citrous fruit is the limequat, which I originated in 1909 by crossing the common West Indian lime with the kumquat orange. I do not need to explain to those familiar with citrous fruits that the lime is the tenderest of all the commonly grown plants of this group. It is frequently frozen to the ground even in southern Florida and is often injured by frosts which have scarcely any effect on other citrous trees. The kumquat, on the other hand, is one of the hardiest of the evergreen citrous fruit trees. This is without doubt due not so much to its direct powers of cold resistance as to its remarkable dormancy. The kumquat is able to pass unaffected through long spells of hot weather which force other citrous trees into a tender and succulent growth that is liable to be injured by even a slight frost. Some measure of its dormancy is indicated by the fact that it flowers from two to three months later than other citrous trees. Fortunately the pulp of the kumquat, although small in amount, is mildly acid and, as might be expected, the hybrids between the lime and the kumquat prove to be of a very desirable character. The limequats vary in size from that of a large kumquat to that of a small lime. The skin is thin and of agreeable aroma and flavor, the pulp juicy and of varying degrees of acidity, some of the hybrids being almost as acid as the sourest lime, others being scarcely more acid than the kumquat itself. Here again we have great variation in first generation hybrids, due probably to zygotaxis, as in the cases of citranges and tangelos.

With this brief summary of the accomplished results I beg leave to direct your attention to what I consider some of the more important lessons of this work, one of the first of the lines of plant breeding work to be established in this country and one which is now being carried out perhaps on the largest scale and with the most complete record of any fruit breeding work. Nevertheless I consider that the work done hitherto is merely of a preliminary order and of comparatively little importance.

As long ago as April, 1893, I read at the Pensacola meeting of the Florida Horticultural Society an account of some citrous fruits which were being introduced into Florida, and emphasized the value of these wild relatives of our cultivated citrous fruits for

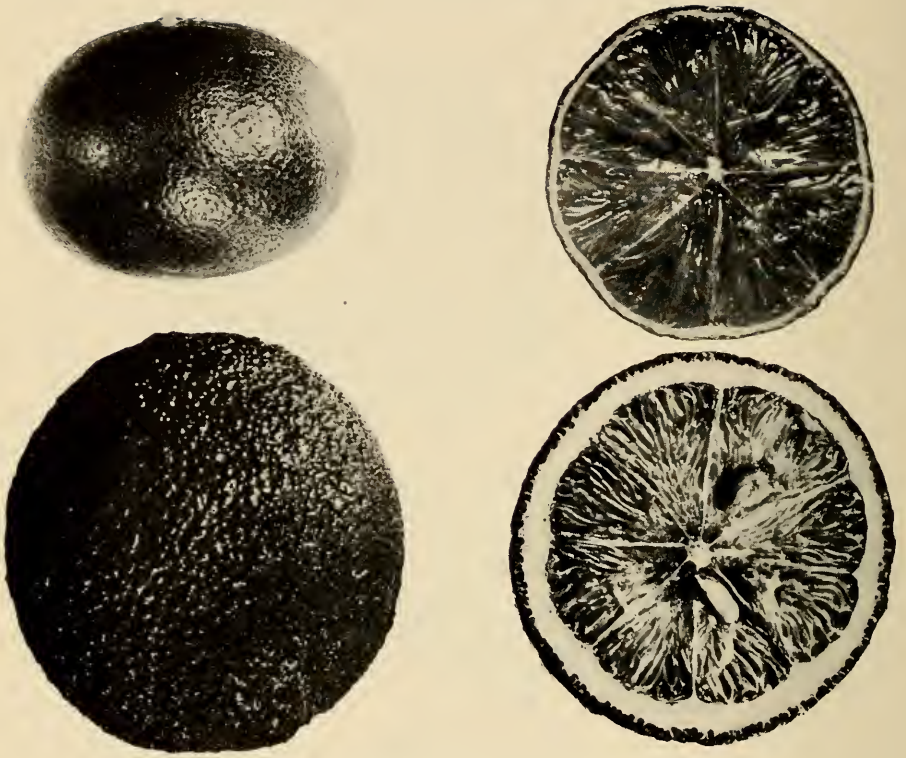
WILLITS CITRANGES.

At the right is the normal type, of excellent quality, while at the left is shown the fingered type, natural size. This abnormal type is uncommon in first generation hybrids, a fact that is not in accord with the ordinary ideas of Mendelism. (Plate 4.)

use in hybridizing.* It was not until some three years ago that I was finally in a position to take up this work planned twenty years ago, but these recent investigations have brought to light a large number of wild relatives of our citrous fruits, undoubtedly closely related to the commonly cultivated species. Many of these plants have been entirely neglected by horticulturists and their relationships misunderstood by botanists. A few examples will prove the truth of this statement. In the deserts of Australia there is found a small acid fruit edible in its wild state, and called by the settlers "desert lime" or "desert lemon" (*Atalantia glauca* (Lindl) Benth). It was first found growing in a region where such thick ice had formed that it had to be broken with an ax before the horses of the exploring expedition could get water to drink. Undoubtedly this desert kumquat has occasionally been subjected to temperatures almost as low as zero Fahrenheit. Here, then, is the hardiest of all the evergreen citrous trees producing in the wild state edible fruit which has, nevertheless, so far as I know, entirely failed to attract the attention of plant breeders in any part of the world. Certainly our correspondence seems to show that the desert lemon is not grown even in the botanic gardens of Australia, to say nothing of those of other countries. After considerable difficulty I succeeded, through the co-operation of the Office of Foreign Seed and Plant Introduction, in securing a quantity of seed of this species, and young plants are now growing in our greenhouses and in the southern and southwestern states. How much more promising is this species for use in breeding hardy citrous hybrids than is, for instance, the trifoliate orange, with its seedy fruit, acrid skin and scanty juice!

Throughout Central Africa there occur a number of species of *Limonia* (*L. Preussii* Engl., and related species) which upon study are found to be very closely related to *Citrus*. They bear large numbers of small, highly-colored, aromatic, delicious-flavored oranges clustered like cherries at the nodes of the branches. After some delay I succeeded in securing from Africa seeds of one of the species of this new group of citrous fruits, which we have been calling "cherry oranges." They grow rapidly and can be grafted readily on all the common citrous stocks. Unlike the species of

* Swingle, W. T., 1893. Some Citrus Fruits That Should be Introduced Into Florida, in Proceedings of the 6th Annual Meeting of the Florida State Horticultural Society, Pensacola, Fla. Pages 111-121. (Read April 13, 1893.) Tallahassee, Fla.



RUSK AND SAUNDERS CITRANGES.

Rusk (above) has a smooth, thin skin of bright orange-red color, while the Saunders (below) has a thick skin and very large, prominent oil glands, making it a good keeper. Both natural size. (Plate 5.)

Citrus, these African cherry oranges have compound leaves composed of from three to seven very large leaflets. It is not uncommon for a single compound leaf of an African cherry orange to have a surface ten times as large as that of a common orange leaf. When we reflect that the sugar that sweetens the fruit and the aromatic substances that give it flavor and perfume are formed in the leaves we realize how important it is to secure large-leaved forms of our cultivated plants.

Through a new system of grafting it has been possible to force some of these African cherry oranges to flower when they were less than two years old. In this way it has been possible to make a few

hybrids with species of Citrus. It can be imagined with what interest we await the result of these first experiments.

Other examples almost equally striking could be given to show what valuable material awaits the attention of the plant breeder. I think I am justified in stating that almost all of the plant breeding work done in this country, or any other country for that matter, has been very seriously handicapped by a lack of accurate knowledge as to the material available for use in hybridizing. I consider it the duty of plant breeders to inform themselves concerning the wild relatives of the groups they are breeding. To do this properly a thorough study of the group is necessary in order to discover the relationships of the different species and to suggest the most promising lines of hybridizing work. When we think of the hundreds of millions of dollars invested in the culture of our fruit and other crop plants and consider how frequently the varieties now cultivated suffer injury or death through lack of proper adaptation to the climate or soil, we realize how great is our responsibility to the people of this country and how imperative it is that we as plant breeders should inform ourselves as to the material at our disposal before spending public or private money in experiments carried on in an inadequate way. I am glad to say that we are now securing for our breeding work on the citrous group the wild relatives of the orange which I was so anxious to get twenty years ago. I think I can assure you that when this breeding work shall have progressed another ten years we shall have been able to demonstrate beyond any possible doubt the fundamental importance of securing a proper equipment of wild species with which to carry on the work.

I have looked into other groups in a preliminary way and am convinced that what I have said of citrous breeding applies with almost equal force to the improvement of nearly all other perennial fruits, berries and vegetables to which breeders are now giving their attention.

The new botany which gives us accurate information as to the number, morphological and physiological characteristics and relationships of the wild relatives of our cultivated plants will soon be recognized as absolutely essential to any defensible project for the improvement of our staple crop plants.

SAMPSON TANGELO.

Young fruiting tree growing at the Plant Introduction Garden, Chico, Calif. This hybrid is now cultivated commercially, and trees often fruit abundantly while still very young. (Plate 6.)

TANGELO AND LIMEQUAT.

Above and below is a Sampson Tangelo, while in the center is a limequat, obtained by crossing the common lime and kumquat. This is much more cold resistant than the ordinary lime. Fruits natural size. (Plate 7.)

Eugenic Immigration

The American Race of the Future and the Responsibility of the Southern States for its Formation. The "Survival of the Fittest"*

ROBERT DE C. WARD

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Eugenic immigration, with its tremendous influence on the American race, shows its possibilities most clearly in the contrast between congested slums of northern cities and the need of labor in the South and West. On the one hand we have the tenement-house districts in all our large northern cities, with a population very largely of foreign birth or parentage; and a growing conviction of the impossibility, even with unlimited resources in men and money, of properly caring for, and of permanently raising the standards of living of, this population as long as it is thus crowded, and as long as the stream of newer immigrants pours in with as little attention to its proper selection as we pay at present. On the other hand we have vast areas in our western and southern States where the farmers, the cotton growers and the mine owners are calling for "labor."

Is it any wonder that the weary social workers of these northern cities are saying that if this congested population could be distributed over the southern and the western states many of the difficulties which are now met with in caring for, in educating, and in assimilating these aliens would disappear? Is it surprising that the farmers, the cotton growers, the mine owners, should on the whole look forward to this new movement of population into their own districts as likely to solve for them the great problem of "lack of labor"? And does it strike any one as strange that our railroads and the foreign steamship companies should favor such a scheme of distribution, which clearly means more business for them?

The people of the South at present hold the key to the immigration problem, eugenically considered. If they say: "We want *anybody* we can get to work for us; if we cannot have a strong, intelligent, skilled laborer we will take one who is of low vitality, poor physique, mentally deficient, and unused to outdoor work," then the

* Address read at the ninth annual meeting of the American Breeders Association, Columbia, South Carolina, January 24, 1913.

charity workers in our northern cities, and our railroad companies, will send all sorts of aliens who are generally regarded as a burden in the North into these southern states.

If, on the other hand, the people of the South clearly recognize the fact that our present immigration laws make it possible for thousands of aliens to land here every year who are likely to be not a benefit but an injury; who are weak and sickly; who may have come because they were inveigled into buying a passage ticket by a steamship agent, then they will insist on having none but honest, industrious, healthy and fit immigrants. Such aliens there are in abundance in our large northern cities, who would be far better off in the country. These are the ones whom the South wants. Shiftless, sickly and unfit immigrants there are also in abundance in our large northern cities. These, I take it, the South does not want. Neither do we of the northern cities want them. Yet they continue to pour in on us because we have not yet properly regulated the flood. To send out from the large cities of the North thousands of unfit aliens who are not desired in the country districts of the West and South, simply because our charitable agencies in the North think they can thus relieve themselves of an unpleasant burden, is much like throwing one's weeds over one's neighbor's fence, into his garden.

There are certain evils which will follow in the train of a wholesale and indiscriminate distribution of our immigrants which the South may well consider. To scatter among our rural communities large numbers of unselected aliens whose standards of living are such that they are willing to work for the lowest possible wage, is to expose our native population to a competition which is distinctly undesirable. Again, the more widely we scatter the newer immigrants, the more widespread will be the effect of the competition with the lower grades of alien labor in causing a decrease in birth rate among the older portion of our population. American fathers and mothers, as the late Gen. Francis A. Walker first pointed out, and as I believe all our leading economists now agree in thinking, naturally shrink from exposing their sons and daughters to competition with those who are contented with lower wages and lower standards of living; *and, therefore, these sons and daughters are never born.* This may, or may not, be for the eugenic welfare of the race, but it certainly does tend, if this condition exists, to bring about a relatively rapid race-replacement. The distribution of *unselected* immigrants throughout the South will, I believe, mean the

gradual replacement of the native by mentally and physically inferior foreign stock, which is already going on in the North.

There is not time on this occasion to take up the evidence, which exists in abundance, of the unsatisfactory and unfit character of much of our present immigration. It is clear that the race migration now going on from Europe and Asia to the United States is to a considerable extent not a "natural" movement, but an "artificial selection," as it were, of some eugenically undesirable elements of the old-world populations. It is evident that a dangerously large fraction of our present immigration is as unfit on the farm as in the city; that it is of low vitality and poor physique; and often diseased and mentally deficient. There is no higher authority on immigration in this country than William Williams, the able and efficient Commissioner of Immigration at the Port of New York: he tells us that our immigration laws "do not reach a large body of immigrants who * * * are * * * generally undesirable, because unintelligent, of low vitality, of poor physique, able to perform only the cheapest kind of manual labor, desirous of locating almost exclusively in the cities, by their competition tending to reduce the standard of living of the American wage-worker, and unfitted mentally or morally for good citizenship. * * * If these persons could have been induced to stay at home, nobody, not even those clamoring for more labor, would have missed them. Their coming has been of benefit chiefly, if not only, to the transportation companies which brought them here." Mr. Williams further says that thousands of incoming aliens are neither physically nor mentally fitted to go to the undeveloped parts of our country and "do as did the early settlers from northern Europe."

The people of the South are in a position to exercise a determining influence upon the character of the future American race, because, whenever any demand is made upon Congress for further immigration legislation, even of so mild yet so necessary a character, for example, as the better exclusion of those who are physically below par and are likely to be undesirable, both economically and as parents of future American children, the argument which is always urged against such a step is that "The South needs labor to develop its resources." The people of the South must realize that a wholesale distribution of unselected aliens will not give them the labor they need; will injure the quality of the American race of the future; will spread more widely the evils which result from

exposing our own people to competition with the lower classes of alien labor. Hence, the South must become a strong supporter of any reasonable measure of a further eugenic selection of immigration, for it cannot fail to see that the continued influx of hundreds of thousands of unhealthy and unfit immigrants is a burden upon and a detriment to the whole country.

Obviously, intelligently directed distribution of desirable immigrants is most essential, but the immigrants must be sent where they will find work which they are physically and mentally fitted to perform. This country needs and wants none but honest, industrious, intelligent, healthy and fit immigrants. Any reasonable legislation which shall improve the physical and mental quality of our immigration should be heartily supported in the South.

The contact between economic and eugenic aspects of immigration is sometimes overlooked. We constantly speak of the need of more "hands" to do our labor. We forget that we are importing, not "hands" alone, but bodies, also. The vast majority of incoming alien immigrants are potential fathers and mothers, and the character of the race that is to be born here depends upon the kind of alien bodies which we are allowing to land on our shores day by day. It is just at this point that immigration becomes a eugenic problem. We, in the United States, ought to have a very special interest in it as such, for we are here forming a new race, of an extraordinarily heterogeneous character, and we have a remarkably favorable opportunity for practicing eugenic principles in the selection of the fathers and mothers of future American children, through our power to select our immigrants. Most of the discussions of this immigration problem in the past have been concerned with its economic side, but the eugenic and racial side far outweighs this. The days of a dominant Anglo-Saxon immigration are over, forever. From a trickling rivulet, forty years ago, when it furnished less than one per cent of our alien arrivals, Southern and Eastern European immigration has increased until it now numbers about 70 per cent of the total. It has become a flood, and the flood is increasing. Asia is contributing more each year. British India has begun to send the advance-guard of its coming millions. There are those who believe that the Anglo-Saxon American will disappear, like the Indian and the buffalo. And there are reasons for thinking that the burden of proof is on those who hold that he will *not* disappear.

Most of us have met these questions of a falling birthrate, and of the production of a new race in this country, with the doctrine of the "survival of the fittest." Some of us have said, "We may be sorry that the Anglo-Saxon race is losing ground; we may not enjoy the prospect of its replacement by a new race, with large strains of Latin, or of Slav, and perhaps also, in time, of Asiatic blood, but, after all, it is a question of the 'survival of the fittest,' and if we are not the fittest, we must, of course, go under." A similar philosophy is urged by those who, opposing all further regulation and selection of alien immigration, even along eugenic lines, rely—or say they do—largely upon the doctrine that free competition will, by a process of natural selection, result in the "survival of the fittest." This whole belief is based on an erroneous conception of the meaning of the phrase, the "survival of the fittest." This expression has been misunderstood and misused so often that the wrong use of it is far more frequent than the right use. What Spencer and what Darwin really meant was the survival, not of the "best," but of those most fitted to survive. These are not necessarily most fitted for any purpose except mere survival. A plant or an animal survives in proportion as it fits its environment. "The kind of microbe," says a recent writer, "that best fits into the environment provided by, say, human blood, is the fittest and will survive and be the cause of the commonest disease. Thus the tubercle bacillus is at once the fittest microbe, and not the best but the worst. In a society of blackguards, the biggest blackguard is the fittest man and will survive. He is also the worst man." "The capacity to fit into the environment is the capacity that determines survival; it has no moral connotation whatever." The eugenic ideal, the ideal of race culture, is to ensure that the fittest shall be the best.

What kind of a race will this be, made up of such diverse elements that, as Professor William Z. Ripley, of Harvard University, says, "the most complex populations of Europe are ethnically pure by contrast"? Truly, this is a "melting pot" for all the nations and peoples of the world. Into it we have allowed Europe, and now even Asia and Africa, to throw every sort of material, while we ourselves have been blissfully—or shall we not rather say criminally?—careless as to what the final product is to be. Will the new American race be a superior or an inferior one? Who shall say? Evidence is available on both sides of the question. Opposite views

upon it are held by those who have studied it. In the midst of a disagreement among the scholars, what shall the layman do? One thing is clear, and that is that the results of biological studies go to show that the crossing of different types must not be carried too far, or be too extreme, or proceed too rapidly. In the light of the evidence it is my opinion that the burden of proof is upon those who hold that the new American race will be superior, rather than inferior.

There can be absolutely no doubt that the recent change in the races of our immigrants will profoundly affect the character of the future American race. What the resulting physical and mental changes will probably be, various authorities have told us. The ethnic composition of an "average immigrant" (whatever that may be!) has radically changed during the past few years, the Baltic and the Alpine stocks giving way to the Mediterranean. The dilution of the energetic Baltic blood, which "combined with the conditions peculiar to a new country," has made us "preeminently an energetic, practical people, above all an industrial and political people," will, according to Professor Franklin H. Giddings, of Columbia University, inevitably cause a decline of this American push. The increasing proportion of Alpine and of Mediterranean blood will "soften the emotional nature, but it will quicken the poetic and artistic nature. We shall be a more versatile people, gentler in our thoughts and feelings because of the Alpine strain; livelier and brighter, with a higher power to enjoy the beautiful things of life" because of the Latin blood. "We may doubtless learn courtesy from many an Italian; virtue from many a Slav; family loyalty from many a Jew; the beauty and the refining influence of music from many a Hungarian." Physically, our average stature will be reduced, and our skulls will become broader and shorter.

He would, indeed, be a hopeless pessimist who should maintain that this racial change will have only undesirable effects, physical and mental, upon the future American race. We probably need less nervous energy and push. We shall undoubtedly benefit by a quickening of our artistic and our poetic nature. We shall probably not be injured by the infusion of some of the "conservative and contemplative stock which comes from southern Europe." The good qualities of this new immigration we may need. The defects we would willingly do without: we have already enough of our

own! But surely, it is rather reckless to assume that everything will settle itself for the best. It may be that the American race of the future is to be a far better, a far finer, a far nobler race than the world has ever seen; better and finer and nobler, possibly, than the American race which we ourselves have known. But let us remember that, as a recent writer has well expressed it, "in forming a race of unknown value, there is being sacrificed a race of acknowledged superiority in originality and enterprise."

Admitting, for the sake of argument, that a mixture of race stocks in this country is desirable, is it not at once apparent that the individuals who are to be the progenitors of this mixed stock should, at the least, be as good, mentally and physically, as the average of those already here, if there is not to be a gradual deterioration of our people? In other words, is not a careful selection of our immigrants, on eugenic lines, of the utmost importance? Here again, we see how the racial aspect of our immigration problem inevitably comes into contact with the eugenic aspect of it.

Conservation of our natural resources: how much we hear about that! Conservation of American forests is important. So is conservation of American coal, and oil, and natural gas, and water supply, and fisheries. But the conservation and improvement of the American race is vastly more important than all other conservation. The real wealth of a nation is the quality of its people. Of what value are endless acres of forests, millions of tons of coal, and billions of gallons of water if the race is not virile, and sane, and sound?

The need is imperative for applying eugenic principles in much of our legislation. But the greatest, the most logical, the most effective step that we can take is to begin with a proper eugenic selection of the incoming alien millions. If we, in our generation, take these steps, we shall earn the gratitude of millions of those who will come after us, for we shall have begun the real conservation of the American race.

New Plants for Breeders

Agriculture of the Future Will Show Marked Changes, as Result of Work of Office of Foreign Seed and Plant Introduction

DAVID FAIRCHILD

*Agricultural Explorer in Charge, Office of Foreign Seed and Plant Introduction, Bureau of Plant Industry, U. S. Department of Agriculture.**

We have learned to expect great changes in our agriculture because we have seen great changes already, but we each see them from a different angle. To me has fallen the lot of viewing agriculture from the standpoint of the plants whose culture composes plant industries. Today no one can afford to take anything less than a world view of agriculture.

It is from this standpoint that agriculture is considered by the Office of Foreign Seed and Plant Introduction, which was established by Secretary James Wilson in 1897, who always took a keen interest in the work of bringing in new plant industries from abroad. The movement was fortunate in being championed from its very beginning by Mr. Barbour Lathrop, of Chicago, who conducted three expeditions at his own expense, taking the writer with him and securing new plants, shrubs and trees throughout the little-known parts of the earth, and turning them over to the United States Department of Agriculture. This office already has been largely responsible for taking the initial steps which have led to such changes in the nation's crops as the introduction of durum wheat, the dissemination of the Siberian cold and drouth resistant alfalfas and the establishment of the date palm in the Southwestern States. The working out of these long-time problems, as is well understood by you, is being carried on by special officers of the Bureau, but I am confident that the near future will see American farmers entering into the production of many more crops which are now monopolies of foreigners, and at the same time improving their present crops in order to hold the markets which they now have. When oceans are highways of cheap transportation; when cold storage has put the Cape of Good Hope and New Zealand into competition with us; when cable letters and thousand-mile wireless

* Extracts from an address delivered before the scientific staff of the Bureau of Plant Industry.

messages make instant communication possible, and twenty-knot boats make yearly visits to any part of the globe an easy possibility, we should no longer allow the farmers to feel safe for an indefinite period as producers of foodstuffs from the competition of the whole world.

We must be on the lookout for great changes and not let a natural conservatism stand in the way of our seeing the coming of such changes. If there were such a thing as an agricultural globe, you would be surprised many times when you came to study it. You would find so little of it inhabited, so many places crowded with incredible millions of people, such vast tropical regions covered with perpetual forests, so little cold country, and so much frostless country. But perhaps what would strike you most would be the fact that you did not know the crops. You would find cultivated plants forming the main food of millions of people and even the names of them would be strange to your ears.

You would travel for miles perhaps through the yerbales of the Argentine and Paraguay or photograph the great orchards of Khat in western Arabia and be surprised that three million or more people take their thein in the form of maté instead of tea and that Khat leaves are so prized by the inhabitants of Yaman as a stimulant for chewing that the poor coolies will pay half their wages for Khat. You would find fields of the chickpea everywhere in Spain, and the shops would be selling them by the bushel. You would see orchards of the dry-land carob in eastern Spain and find the hillsides of Crete and Candy and southern Italy covered with the same beautiful shade tree, the pods of which are one of the best fodders known. You would find the Chinese growing strange water plants in their canals and ponds and making candied delicacies from their roots or using them in their soups and stews. You would see the Japanese sea-shore farmers cultivating sea weeds on stakes set knee deep in the water of their coast or piling up logs on which to grow their edible mushrooms or tending carefully hundreds of acres of giant grasses or bamboos for the tender succulent shoots which they produce and the incomparable woody material which they get from their stems. You would look down on square miles of palm trees in the oases of Arab countries and see the Arabs gather more dates from a single palm tree than you ever saw in your whole life before, and you would see that there were as great differences between date varieties as there are between apples.

You might see some of the other great palms of the world,—the oil palm of Africa, whose culture is rapidly growing into a great industry, or the ivory palm of Columbia, which furnishes our buttons, or the sugar palm of Java, which makes as fine-flavored a sugar as our maple, or that other one in Chile which formed forest now rapidly disappearing to furnish sap for the syrup makers.

You would notice lines of cattle and camels tethered in great fields of berseem clover, fattening on it, and you would learn that alfalfa is being introduced into Egypt, but has not yet proved as good as berseem on the Nile silt. You would see the peasants of Malta bundling up six-foot-tall sulla clover which their forefathers for centuries have grown on the limestone soils of that tiny island, and whose culture probably came from the neighboring coast of Tunis. You would find pistache nuts and pistache candy was being hawked about the streets of Athens as roasted peanuts and peanut candy are in Washington.

And let us not think, because these are old cultures—often many centuries old—that they are doomed whenever they come into competition with the crops which we happen in this country to have taken up first as settlers in America.

Let me ask if anyone can tell why the cassava will never compete with corn for food production or why the avocado should not rival the orange as a table food or the Oriental persimmon be eaten fresh or dried by millions throughout the South, or the prickly pear fruit, which will keep a year without spoiling, become an important article of commerce? These all sustain life, and why should not they be utilized and compete for their proper places in our agriculture? They will compete and are competing just as so many other things have competed and won out.

I realize it is very difficult for one to believe that something which he personally dislikes can ever make a market for itself, but taste is largely a matter of habit. Steffanson related the other evening in my hearing how some of his sledge dogs which had always fed on seal meat refused and one of them nearly starved to death on caribou meat, while dogs accustomed to caribou meat absolutely had to be starved before they would touch seal meat. We shall not be able to starve people into eating things, but fashions in food will change and bring up the new things so often to them that they will learn to eat them. It is a slow process, but it is working all the time all over the world, as is evidenced by the

new beef and mutton stalls in Japan and the Chinese restaurants in America, and the immense soy bean exports from Manchuria to Germany. Things which you have always thought of as of small importance because you knew so little of them, you find to be the great money crops covering square miles of territory and absorbing the lives of hundreds of thousands of people. These considerations have made some of us feel that the American farmer is familiar with very few crop plants and has led us to wonder whether it were not a short-sighted policy to keep him in ignorance of the world products and their production which at any time may become competitors.

One of the first great objects of the work of plant introduction is to get the farmers of the country to realize that there are many more kinds of farming than they dreamed possible, and that new kinds are coming into existence all the time in various parts of the world, and that there is no reason why the kinds should not be rapidly increased. To develop a race of thinking, independent farmers, we must give them a chance to see the crop plants which could be grown in their localities and give them time to think about them. There is something wonderful in the practical sense of an American farmer and in his ability to turn things about him to account. How can this be done unless a systematic search of the world is made, and hundreds of thousands of plants imported and scattered where thinking men and women can see them and devise means of utilizing them? There are many thousands of people who enjoy the pleasure which comes from growing something which they have never seen before and finding the best use for it. This plan of going out into the highways, not only in search of the crop plants but the experimenters who will test them, is an American plan and differs essentially from the arboretum plan of the old world whereby the plants were brought in and kept in a menagerie, as it were, under lock and key, so carefully that few farmers ever saw them, much less had a chance to grow them. Dr. Gustav Eisen, a Californian, has just written from Rome that there is in the Pincian garden there an avocado tree one hundred years old, and yet one of Italy's best horticulturists was here not long ago and was eager to know about the avocado tree which he had seen in California. This illustrates the difference in the method. Our plans have been to propagate avocados by the thousand and send them everywhere in hopes of getting into the hands of every one who is a good experimenter

one or more of these trees, which in a few years would stir the man's imagination by its remarkable fruit.

Let those who can, co-operate in this work by putting into their gardens some new plants for the pleasure merely of playing with them and watching them grow, and the country will reap the benefit either directly, in the establishment of them as new industries, or in the bearing which they have on the work done on other crops. Some of my critics have raised the point in regard to this work that men get discouraged in trying to grow new things, and that, therefore, new plants should not be sent them until they were thoroughly tested and proven to be successful. In other words, the government, at excessive expense, should make a perfect money-making thing, and then make a market for it, and then give it away to people who could make money out of it. This is not my conception at all of the way our agriculturists are to be made into the most resourceful, independent, progressive elements of our civilization. The successful farmers are men who learn how to find out things for themselves, and any method which stimulates the thirst to know and find out is far better than one which teaches methods, no matter how good the methods may be.

Plant introduction then, as it is being developed in the bureau, is an instrument for arousing interest and developing the spirit of inquiry among the farmers.

Carried on as a government policy over a long series of years, what will be the result of this plant introduction work? That is the question which statesmen have to decide. To my mind there can be no question that it will be one of the great agents in the diversification of our agriculture and help to lessen the losses which occur by the shifting of farm industries from one region to another. It is in line with the development of the human race, which is moving from the one food basis of the savage toward a multiple food standard. It will lead to substitution in our foods of better for inferior things. It will result in the creation of those natural plant monopolies upon which the agricultural wealth of a country should rest, monopolies such as have made the peasantry of France so well to do. It will lead to the utilization of land by that crop which is best able to create food or other valuable material on that land. It will lead to the substitution of tree crops for annual crops wherever they are of advantage. It will assist in the utilization of waste lands all over the country. It will help make the roadsides,

THE LARGEST WILD ROSE KNOWN

(*See photograph on opposite page*)

The Giant Rose of the Himalayas (*Rosa gigantea*) probably has larger flowers than any other wild rose in existence. In their native forests the flowers often reach a diameter of six inches; cultivated they should exceed this. The rose is furthermore a vigorous grower, as will be seen from this photograph of a specimen at Funchal, Madeira. It was introduced to the United States in 1902 by the Office of Foreign Seed and Plant Introduction of the U. S. Department of Agriculture, and on a number of occasions since then, and at once attracted the interest of hybridizers, who try to retain its size and vigor, while increasing its hardiness by crossing with a more cold-resistant specimen. Dr. F. Franceschi of Santa Barbara, California, has made several hybrids, which showed vigor and hardiness as well as great beauty, the flowers being creamy white with yellow centers. At the Botanic Gardens in Lisbon, Portugal, it has been crossed with the well-known rose Reine Marie Henriette, and large, rich, orange-yellow flowers produced. In warmer regions, such as California, the Southern states, and the Riviera of the Mediterranean, it is cultivated for its own sake, and its flowers, sometimes not borne very profusely, are often pure gold in color. Sir Joseph Hooker mentions a red form in Sikhim, India, but the best known type is white. Its fruit, as large as a small apple, is edible and sometimes sold in the Indian markets. The bush often makes a growth of 40 feet or more, dropping its blossoms (which at a short distance look like Clematis) from the tops of tall trees in upper Burma and western China. It flourishes best in shade.

city streets, parks, and yards more attractive as it has made them in England by the discovery of ornamental plants adapted to cultivation here. It will help prepare the young horticulturists of America for the opportunities of the tropics which are opening with such remarkable rapidity and which are sure to attract American capital and enterprise on a gigantic scale. It will do its part in enlightening the American farmer on what the other farmers of the world are doing and furnish him the material with which to compete with them in a host of lines. It will encourage the improvement of our staple crops through hybridization and selection and by the creation of entirely new hybrid crop plants whose performance is better in some commercial respect than those we now have. It will help to educate the taste of the people and show them how largely agriculture is dependent upon the caprice of fashion. It will help us to know more about the botany of our cultivated plants and study them from the broad comparative standpoint.

The Office of Foreign Seed and Plant Introduction has now been in existence for fourteen years, and its function as a part of the Bureau of Plant Industry is, I believe, pretty generally recognized. It may, however, be worth while to summarize its activities.

It has maintained since its inception one or more agricultural explorers in foreign countries. These men have been of two kinds—those like Frank N. Meyer, who have gone into out-of-the-way places and blazed the way, so to speak, for more careful detailed work later; and those who, as members of the Bureau staff, have gone out for some particular purpose, such as the investigation of some special crop or series of crops.

Of the early explorers and the romance of their travels I hope some day to publish. The public at large—hero worshipers of adventure—are now keen to learn of the hair's breadth escapes and dangers of their plant explorers, but I trust some day they will realize, as those of us do who have been out, that the great romance of this work lay in trying to forecast the future of each plant found and introduced. Time will permit me barely to mention the names of the men who have done this work. Fairchild, Swingle, Cook, Collins, Bolley, Bessey, Hansen, Carleton, Kearney, Piper, Galloway, Aaronsohn, Oliver, Knapp, Tracy, Scofield, Lake, Onderdonk, Magelssen, Meyer, Rose, Rolfs, Mann, Tull, Hills, Shear, Wight, Fraile, Boyle, Barrett, have all contributed with explorations of greater or lesser magnitude.

Aside from their direct acquisitions, these exploring trips result

in the formation of a host of foreign contacts—with agricultural experts, collectors, explorers, government officials, missionaries who represent in many cases the best men in their respective countries. With these we continually carry on exchanges of seeds and plants, and we pay them liberally for anything of value they send us. In this way, our work never stops. Correspondence with them forms a large part of the work of the office at Washington, and correspondence with United States consuls abroad is another fertile field. Many thousands of dollars' worth of work is done for us each year by consuls without compensation, and many valuable acquisitions have been made in this way.

In order to preserve an historical record of the data which accompanies this plant material, the inventory of plants imported was begun and has been maintained for thirteen years. Friends of the work declare that this is rapidly becoming of great value merely as a work of name reference. Certainly there are nowhere gathered together so many fresh impressions of travelers and foreign experts regarding the value and uses of economic plants and trees.

To supplement this inventory record there was organized and is now in full operation the economic seed collection and herbarium, and already the seed collection has become one of the most extensive in the world. This branch of the work will from now on be of increasing importance, and plans have been perfected whereby specimens of everything introduced, so far as possible, will find their way into the herbarium as soon as they have been grown and show enough characters to warrant herbarium specimens being made.

The Office is now well equipped with gardens where the plants are propagated and from which points they are sent out for trial. These are located at Chico, California; Brooksville and Miami, Florida; Yarrow, near Rockville, Maryland, and Brownsville, Texas. We have found by experience that we must have considerable amounts of material to accomplish anything substantial. The distribution of 500 trees throughout a region where they seem promising is none too many to secure a reading on its possibilities.

Practical photography has come into existence almost since the work of plant introduction began, but it is now one of the most remarkable aids in the dissemination of an interest in new fruits and other useful plants, and I believe it is safe to say that there is nowhere in the world a larger or more varied collection of photographs of economic crop plants. It is our object to make this of

the greatest possible utility to experimentation, and already hundreds of these photographs have drifted out into the ephemeral literature of the country, notwithstanding our very restricted outlets of publication.

To summarize the whole situation the Office of Plant Introduction has the following facilities which it offers to put at the disposal of the various other offices of the Bureau, the State Experiment Stations, and the private experimenters of the country:

Means of getting foreign plants into the country quickly through explorers and correspondents either on its own initiative or when requested to.

Means of recording these introductions in printed book form, as photographs, as seed or as herbarium specimens.

Means of fumigating and disinfecting these plants and seeds and minimizing any possible danger of introducing plant parasites.

Means of advertising these plants directly to experimenters by mimeographed bulletins of information.

Means of distributing these plants with proper descriptive labels to experimenters all over the country.

Means of recording every one of these distributions in such a way that ten years later it can be hunted down.

Means of following up the more promising introductions and fostering them to a point where other agencies can take them over and make financial successes of them.

Means of keeping track in the literature of new plants which come into prominence in foreign agriculture and finding out whether they are worthy of introduction into America.

Constructive Eugenics

An increase in the superior element (of our population) seems to be a more important factor in producing improvement than a decrease in the inferior element. Even if we were to go to the extreme length of cutting off entirely the reproduction of the inferior, this would not lead to an increase in the numbers of the superior, but on the contrary to a decrease; for some of the superior are the offspring of inferior parents, just as some of the inferior are the offspring of the superior.—From a report by Alexander Graham Bell, chairman of the committee on eugenics, in Proceedings of American Breeders Association, vol. IV, p. 208.

Color Inheritance in Swine

Its Relation to Dominance and the Theory of Gametic Purity; are Several Germinal Factors Required for Each Color?*

W. W. Smith,

Purdue University, Lafayette, Indiana

Of the large mass of data available upon the Mendelian behavior of color characters in transmission there appears to be little, if any, which relates to crosses between our common breeds of swine. Since 1903 there has been some cross-breeding work in progress on the Purdue University farm, chiefly with the Yorkshire breed on the one side and the Poland China or Berkshire breed on the other. This work was carried on by Prof. J. H. Skinner with the purpose in view of producing a more profitable type of hog for the Corn Belt farm by combining the prolificacy of the Yorkshire with the early maturity and lard type character of the Poland China and Berkshire. The color records of this work have furnished considerable data relative to dominance and the theory of gametic purity. More recently matings have been made with the direct object of determining the degree and completeness of segregation in the F_2 or second hybrid generation.

The results submitted were secured with crosses between the Berkshire and Yorkshire breeds, and the Poland China and Yorkshire breeds, parent individuals representing these breeds being in all cases pure bred and registered. In all there are reported data upon the color of 115 F_1 individuals and 24 F_2 individuals. In addition, 56 F_2 individuals were produced by crosses of Berkshire-Yorkshire sows with Berkshire sires, and 9 by crossing a Berkshire sow with a Yorkshire-Berkshire sire.

In all first crosses of the breeds tested, there has never been an exception to the rule that white completely dominates black in all the 115 individuals produced. The eyes have always been pigmented. Reciprocal crosses have in all cases given identical results.

The following tabulation presents in detail the results in all first crosses:

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*Paper read before ninth annual meeting of the American Breeders Association at Columbia, South Carolina, January 25, 1913. Photographs by J. C. Allen.

SECOND GENERATION HYBRIDS.

The original parent colors are expressed separately, being unit characters and never blending in a gray, as one might expect. Cross-bred Berkshire-Yorkshire sow with pigs by Yorkshire-Berkshire sire. (Plate 8.)

Dam.	Sire.	Color and number of pigs.
Yorkshire No. 849	Berkshire (P. R.)	15 all white
Yorkshire No. 502	Berkshire (P. B. D.)	6 all white
Yorkshire No. 639	Berkshire (P. 632)	11 all white
Berkshire No. 928	Yorkshire (E.)	6 all white
Yorkshire No. 395	Poland China (G. P.)	12 all white
Yorkshire No. 394	Poland China (G. P.)	12 all white
Yorkshire No. 442	Poland China (344)	6 all white
Yorkshire No. 547	Poland China (P. C. B.)	9 all white
Yorkshire No. 515	Poland China (I. C.)	10 all white
Poland China No. 282	Yorkshire (390)	8 all white
Poland China No. 853	Yorkshire ($2P_2$)	11 all white
Poland China No. 595	Yorkshire	9 all white

Summary.

Yorkshire	Berkshire	32 all white
Berkshire	Yorkshire	6 all white
Yorkshire	Poland China	49 all white
Poland China	Yorkshire	28 all white
	All crossbreds	115 all white

The breeding of the pigs shown in Figure 8 is indicated by the following representation:

F_2 Pigs..... { Crossbred (701)... { Yorkshire (E) / Berkshire No. 161 } / Crossbred No. 514. { Berkshire (P. R.) / Yorkshire No. 639 }

The following represents the breeding of the pigs shown in Figure 9:

A YORKSHIRE-BERKSHIRE CROSS.

Of seven pigs originally in this litter, only one showed any trace of black—a marked example of the proposition that white dominates black in crosses of these breeds. This is the second filial generation. (Plate 9.)

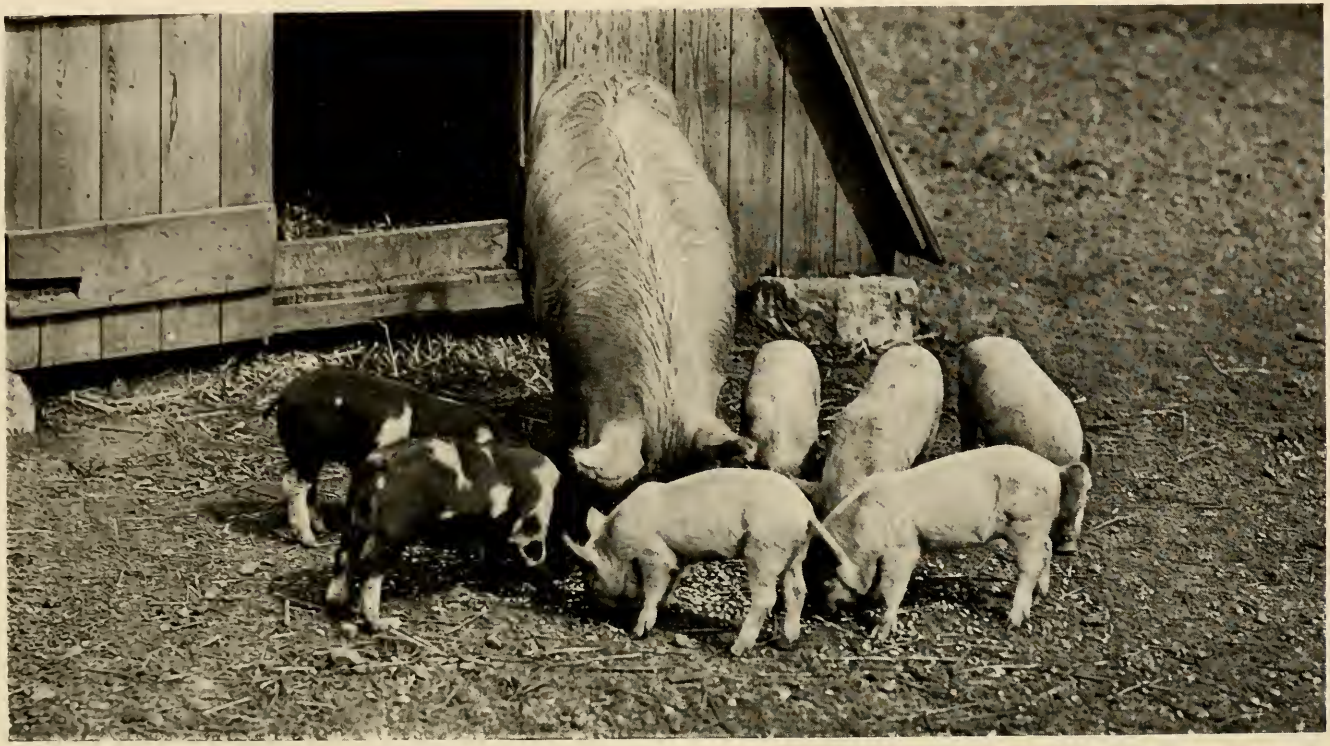
F_2 Pigs
- Crossbred (701)...
  - Yorkshire (E)
  - Berkshire No. 161
- Crossbred No. 513.
  - Berkshire (P. R.)
  - Yorkshire No. 639

The ancestry of the pigs shown in Figure 10 is identical to that of the pigs shown in Figure 9.

The fundamental idea of Mendelism is that of gametic purity. Assuming that the original Yorkshire parents possessed but one color factor in their germplasm, that being white as expressed in the individuals, and assuming likewise that the germplasm from which the Berkshire parents developed contained but one color factor, black, and that producing the characteristic black with a tendency to six white points, the pigs of the F_2 generation would be either white like the Yorkshire or black like the Berkshire, provided the gametes remained pure and preserved their identity during their association together in the F_1 or hybrid individuals. Or, assuming that the Yorkshire white and the Berkshire black of the parents are each an expression of a number of color factors or units in the germplasm, instead of a single unit, and these all moving together and behaving as a unit, the result, with gametic purity and unit behavior, would, according to the same theory, produce either the straight Yorkshire or the straight Berkshire color in the second hybrid generation.

Of the 26 pigs produced of the F_2 generation 20 were white and 6 black, all of the blacks being more or less splotched with white as shown by the illustrations. The ratio of 20 whites to 6 individuals mostly black is close enough to the typical "three to one" ratio to be strongly suggestive.

From the Mendelian point of view these results seem to indicate, first, that instead of a single germ factor for each of the parent Berkshire and Yorkshire colors, there are several factors in the case of one or both, and secondly, that this set of factors or units, say of the Berkshire, does not completely behave as a unit when crossed with the Yorkshire. The contact of the Berkshire set of factors



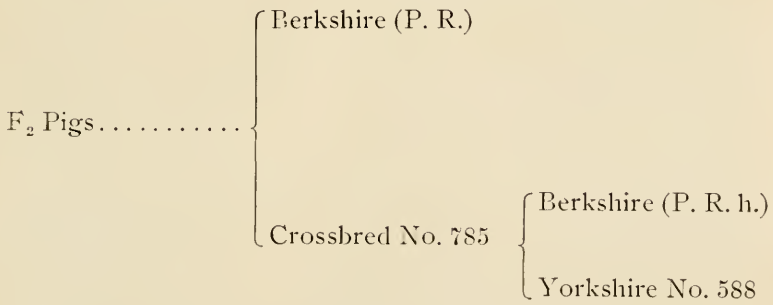
THE MENDELIAN RATIO.

In this second generation litter of Yorkshire-Berkshire hybrids, seven pigs were white and two black with a little white, a close approximation to the ratio of 3 to 1 which Mendel's law requires. (Plate 10.)

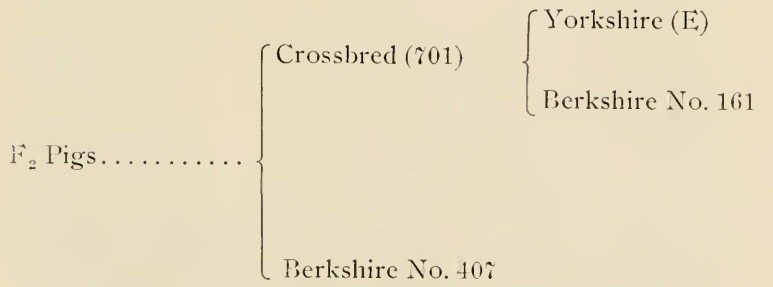
with the Yorkshire factor or factors in the first cross may disturb or destroy the unity of one set or the other. With this assumption the result would probably be independent behavior on the part of some of the factors in the production of the F_2 or second hybrid generation instead of a behavior determined by the whole set as a unit. This hypothesis would allow a Mendelian interpretation of the results presented.

Fifty-six pigs have been produced by mating Berkshire-Yorkshire sows with Berkshire sires. The results of all these matings are fairly represented by the litter shown in Figure 11. Also, one litter of 9 pigs was produced by mating a Berkshire sow with an F_1 hybrid sire. The result of this mating was two white pigs and seven in whom black predominated. Two of the latter died.

The following pedigree shows the breeding of the pigs shown in Figure 11:



The breeding of the litter of nine pigs above mentioned is shown by the following pedigree:



The results secured in mating when one parent was a first generation hybrid of the Berkshire and Yorkshire, and the other a Berkshire are shown in detail by the following table:

THREE-QUARTERS BERKSHIRE.

An exceptionally large proportion of black was shown in this cross of a Berkshire-Yorkshire sow by a Berkshire sire. Two other pigs, which died, were preponderatingly black in color, making only five of eleven pure white. (Plate 11.)

Dam.	Sire.	Number and Color of Pigs.
Berkshire-Yorkshire No. 785	Berkshire (P. B. D.)	3 white, 3 black with some white
Berkshire-Yorkshire No. 785	Berkshire (P. B. D.)	5 white, 6 black with some white
Berkshire-Yorkshire No. 785	Berkshire (P. R.)	7 white, 5 black with some white
Berkshire-Yorkshire No. 834	Berkshire (P. B. D.)	7 white, 5 black with some white
Berkshire-Yorkshire No. 834	Berkshire (P. B. D.)	6 white, 4 black with some white
Berkshire-Yorkshire No. 794	Berkshire (P. B. D.)	2 white, 3 black with some white
Berkshire No. 407	Yorkshire-Berkshire No. 701	2 white, 7 black with some white

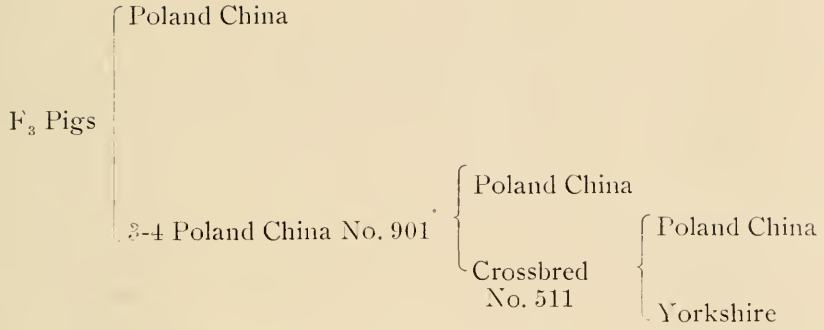
If the hybrid parent in each case had produced gametes one-half of which, on the average, contained the color factors intact as they were contained by one of its parents, and one-half of which contained unaltered the color factors of the other parent, there would have been produced 32 pigs of one parent color and 33 pigs of the other parent color. The actual results were 32 white pigs and 33 which were black with some white.

By mating a three-quarter bred Poland China sow, white in color, with a Poland China sire two litters of 21 pigs have been produced. Figure 12 shows the colors of one litter of the pigs, which were seven-eighths Poland China. The other litter was smaller, but the coloration similar.

The following shows the pedigrees of the pigs in these two litters:

IN THE THIRD GENERATION.

Three-fourths Poland China sow bred by Poland China sire. In this generation the white pigs seem infected by black, while in the two first generations the reverse appeared to be the case. (Plate 12.)



Considering both the above litters, 11 were black or mostly black, 7 were mostly white, 2 were white, and 1 half black and half white. Instead of the black pigs showing apparent contaminations of the white, as appeared to be true in practically all of the F_2 pigs produced, the white pigs seem to have been infected with black.

These results show, in the first place, complete dominance of the Yorkshire white over the Berkshire or Poland China black in the F_1 or first hybrid generation;

Secondly, they show a general tendency for the original parent colors to be expressed separately, and in the proportion of 3 dominants to 1 recessive, in the individuals of the F_2 or second hybrid generation, and

Thirdly, in nearly all cases the recessive black of the F_2 generation carried more white than the original black parents. This suggests the requirement of a number of germinal factors for each color rather than a single factor. Although the factors may behave as a unit or single factor when mated with individuals carrying like factors, when crossed, the unity is destroyed and independent behavior on the part of some of the factors is the possible result.

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MENDELISM AND INTERSPECIFIC HYBRIDS. O. F. Cook. Reprint from *Amer. Naturalist*, XLVII, 239-245, April, 1913

FRUITIERS EXOTIQUES SUR LA CÔTE D'AZUR. Dr. A. Robertson Proschowsky. Reprint from *Petite Revue Agricole et Horticole*, 1912.

COMPETITION IN CEREALS. E. G. Montgomery. Bul. No. 127, Agr. Exp. Station of Nebraska.

NATIVE SEED CORN. E. G. Montgomery. Bul. No. 126, Agr. Exp. Station of Nebraska.

WHEAT BREEDING EXPERIMENTS. E. G. Montgomery. Bul. No. 125, Agr. Exp. Station of Nebraska.

MY LITTLE SISTER. Elizabeth Robins. Dodd, Mead & Co., New York, 1913.

IV^e Conférence Internationale de Génétique, Paris, 1911. Comptes rendus et rapports édités par Ph. de Vilmorin, Secrétaire de la Conférence, Paris, 1913, gr. 8., 10 + 571 pp., 10 col. plates, 4 full page cuts, and 206 text cuts.[1]

[1] Masson et Cie, 120 Boulevard Saint-Germain, Paris (VI^e). Price 25 francs.

This very well gotten up report of the fourth International Congress of Genetics, held at Paris from Sept. 19 to 23, 1911, is a result of the tireless energy and unflagging interest of the secretary, M. Philippe L. de Vilmorin, already known to many of the readers of the American Breeders' Magazine. As these congresses are wisely held only once every four years there is always an abundance of new and important matter to discuss.

The report of the proceedings of the Congress is in French and occupies 60 pages. The original papers are printed either in French or English; if in French they have an English résumé, and if in English they have a French résumé. Forty-two papers contributed by many of the best-known students of genetics are printed in the report, accompanied in many cases by the discussion. The articles are profusely illustrated and the interest of the report is enhanced by the fact that a portrait of almost every delegate is printed along with his paper.

In view of its good paper, clear type, excellent and very numerous illustrations, as well as because of the number and interest of the papers and the excellence of the editorial supervision, this report is sold at a very low price. It should be in the hands of every one interested in plant or animal breeding or in eugenics.

WALTER T. SWINGLE.

Association Matters

Following the change in administration of the Department of Agriculture, and the consequent change necessary in the officers of the American Breeders Association, a meeting of the council was held at the Smithsonian Institution, Washington, D. C., on April 22, 1913, at which Messrs. Castle, Cook, Davenport, Fairchild, Kearney, Swingle and Van Wagenen were present, Messrs. Webber, Detlefsen and Hays being represented by proxies in the hands of Messrs. Swingle, Cook, Fairchild and Kearney. On motion of Mr. Davenport, it was decided to incorporate the association and reorganize it financially. Mr. Castle, as chairman, appointed Alexander Graham Bell, T. H. Kearney and David Fairchild as a committee on incorporation, and, on April 28, the association was incorporated under the laws of the District of Columbia, retaining its old name and taking over the membership and interests of the unincorporated

association. Mr. Fairchild undertook to raise a guarantee fund of $3,000 annually for three years, in order to enable the association to continue its work, and was successful in doing this, through the generosity of a number of friends and members of the association.

On June 18 a formal meeting of incorporation was held, at which a revised constitution and by-laws were adopted to comply with the corporation laws. These will be printed in THE AMERICAN BREEDERS MAGAZINE as soon as space permits. Control is vested in a council of nine, three of whom are to be elected annually, to serve for three years. The following were elected as members of the council to serve until the next annual meeting, when a new council will be elected by the entire membership of the association: David Fairchild, W. E. Castle, Arthur W. Gilbert, W. S. Anderson, Bleecker Van Wagenen, Alexander Graham Bell, George M. Rommel, O. F. Cook and T. H. Kearney.

On September 1 a meeting of the council was held in the Cosmos Club, Washington, D. C., to complete organization. The following officers were nominated and elected, to hold office until the annual meeting in January, 1914: president, David Fairchild; vice-president, W. E. Castle; secretary, George M. Rommel; treasurer, Corcoran Thom. As editor of THE AMERICAN BREEDERS MAGAZINE, Paul B. Popenoe, of Altadena, California, was elected. It was voted to begin the publication of the magazine on a monthly basis as soon as possible.

At the last meeting of the old council, an advisory vote favored a change in the name of the magazine to make it indicate more clearly the broad field which it covers. "The American Genetics Magazine" was suggested as a title. The new council decided that the present title ought to be retained for the three numbers which will complete the present volume. Beginning with the first number of volume five, in January, the name of the magazine may be changed, at the same time that the magazine is increased to the standard magazine size of seven by ten inches. Suggestions of a suitable name will be welcome.

At the last annual meeting of the association, Dr. Alexander Graham Bell of Washington, D. C., and Victor Lemoine of Nancy,

France, were elected honorary life members, in recognition of their unusual services to the science of genetics.

A resolution was passed urging upon all public forest bureaus and private agencies the importance of devoting some of their time and money to experiments for improving the productive capacity of forest and nut-bearing trees, by systematic experiments in breeding.

A resolution was passed urging a stricter examination of aliens at their points of entry as immigrants to the United States, with a view to preventing the entry of many who are mentally and physically defective and yet obtain admission because of inadequate laws and facilities,—not because of lax enforcement of the existing laws. The association recommended that "Decision No. 120" and the decision that minor children of naturalized immigrants are exempt from the operation of the immigration laws should be reversed, and that the period of deportation, except in the case of immoral persons, as to whom there is and should be no limit of time, should be extended to five years, and that the burden of proof should be changed so that the alien must show that the cause of his becoming a public charge arose subsequent to his landing.

Owing to postal regulation, the publishers of *Outdoor Life and Recreation* have been obliged to discontinue sending their publication to members of the American Breeders Association, as was formerly done through the generosity of Charles Willis Ward.

By a vote of the old council, the fee for life membership, which in the past has been $20, was increased to $50.

The next annual business meeting of the association will be held in Washington, D. C., on the second Thursday in January, at five o'clock in the afternoon.

THE GREVY ZEBRA AS A DOMESTIC ANIMAL

For Crossing It Possesses Much More Finish Than a Jack—Difficulties of Hybridizing—Success by Artificial Means—No Sign of Telegony

GEORGE M. ROMMEL

Chief of Animal Husbandry Division, Bureau of Animal Industry, Department of Agriculture, Washington, D. C.

The Grevy zebra (*Equus Grevii*) is one of the few known wild animals which promise to have value for the use of mankind, but with which few attempts at domestication have been made. It is the largest of the zebras, measuring between thirteen and fourteen hands and weighing about 800 to 900 pounds at maturity. It is also by far the handsomest of its kind—a splendid animal, with striking markings which are distributed in a beautiful pattern over the body and legs.

This zebra inhabits the highlands of Abyssinia and Somaliland in Africa and apparently is comparatively rare. Many people believe that it would be worth domesticating and that by systematic feeding and breeding its size can be increased and its numbers likewise.

Popular attention in the United States was first directed to this animal in 1904, when the late Emperor Menelik of Abyssinia presented a number of animals to President Roosevelt, among them being a male Grevy zebra, which was promptly christened Dan. This animal, secured largely through the initiative of Hon. Robert P. Skinner, special commissioner to Abyssinia, and Dr. Baker, of the National Zoological Park, was placed with the others in the donation at the Zoological Park in Washington, where he received a great deal of admiration. Perhaps the first American who conceived the idea of using this zebra as a sire of mules was the present Postmaster General, Hon. A. S. Burleson, then a Representative in Congress and a member of the House Committee on Agriculture. At any rate, this idea was an active one with Mr. Burleson, and he

JERRY, A MALE GREVY ZEBRA.

He promises to have value as a domestic animal because his disposition is reasonably good, and he has "finish." The breeder of common mules must depend on the mares for finish; in breeding mules from the zebra, finish can be obtained from the sire also. It has been necessary to make the cross artifically, but success by natural means may be obtained later, since it has been done with Burchell's zebra.

induced the Bureau of Animal Industry to take up the experiment in crossing the zebra with mares. The consent of the President was obtained to use the zebra for this purpose, and in the spring of 1905 a cooperative agreement was arranged with the National Zoological Park and the Maryland Experiment Station to carry on the work. Six good-sized farm mares were purchased. Five of them were grade Percherons weighing 1200 to 1400 pounds, and the sixth a grade coach mare weighing about 1200 pounds. For a year attempts were made to cross the zebra direct with the mares at the Zoological Park without results.

The Bureau reached the conclusion that a zebra was somewhat

like a jack and, if he had not been raised with horses, might show some disinclination to mate with mares, or even refuse to do so at all. Therefore, arrangements were made with Hon. Robert P. Skinner, then American Consul General at Marseilles, France, to obtain a pair of Grevy zebras so that the Department could begin breeding zebras. Mr. Skinner induced the Ras Makonnen, Governor of Harrar, Abyssinia, a potentate next in power to the Emperor, to present a pair of zebras to our Government. He did so in 1905, but the female died on the railroad while being shipped to the port of Djibouti. The male arrived at New York on January 30, 1906, and in a couple of days reached the National Zoological Park in Washington in good condition. He was young and in fine condition but misfortune had set mark on him also, and on a fine day during the following spring he met with an accident which killed him.

In August, 1906, the original Grevy zebra, Dan, and his equine consorts were transferred to the Experiment Station of the Bureau of Animal Industry, near Bethesda, Maryland, and shortly thereafter some small mares were purchased with the idea that perhaps the zebra might mate more readily with an animal more nearly his own size. After a year or more of discouragement, this was given up in the case of this particular zebra. He evinced a positive aversion to them, although he was kept in the same stable with them for weeks so that a mutual acquaintance could be established. When it was finally decided to turn the zebra and one of the mares into the same paddock, Dan rushed at the mare and would undoubtedly have killed her had he not been driven back into his stall.

There were, at the Station, a number of the small asses of the Southwest, commonly known as burros, and it was soon found that Dan would mate with them readily. These animals were later supplemented with a fine Kentucky jennet which was also bred to Dan. A number of hybrids of this mating have been obtained which have been described in previous articles.*

Meanwhile the Bureau kept at the problem to establish a stud of zebras. In the spring of 1907, Consul-General Skinner was ordered to purchase a pair of Grevy zebras. They arrived in September of that year, but the female died from a ruptured liver

* "A Note on Zebra-Hybrid Breeding," by E. H. Riley, 26th An. Rpt., Bu. An. Ind., pp. 229-232.
"A New Zebra-Hybrid," by E. H. Riley, A. B. A., Vol. VI, pp. 72-75.

THE MOTHER OF THE ZEBRA HYBRID.

The registered Morgan mare, Baby Gates, Vol. III, A. M. R., by General Gates (666), dam Polly B, Vol. III, A. M. R. She first foaled the Grevy zebra hybrid Juno and then the pure-bred Morgan filly Georgia, Vol. IV, A. M. R. If telegony were a fact, the latter foal should have shown some stripes, as a result of the previous impregnation by the zebra; no stripes were shown, however, and it is concluded, on this and much similar evidence, that telegony has no foundation in fact.

shortly after reaching the Experiment Station. However, the male, Jerry, lived and is now in the Bureau's possession. In April, 1908, two female zebras were received from the same source. At last we felt that we had made a start at establishing a stud; but again misfortune dogged our tracks and one of these females died of heart trouble in October, 1908. The other was bred to Dan and gave birth to a dead female foal on September 22, 1909.

In 1910 the Bureau acquired its experimental farm near Beltsville, Maryland, and Dan was returned to the National Zoological Park, where he is quartered with one of his burro hybrids in the

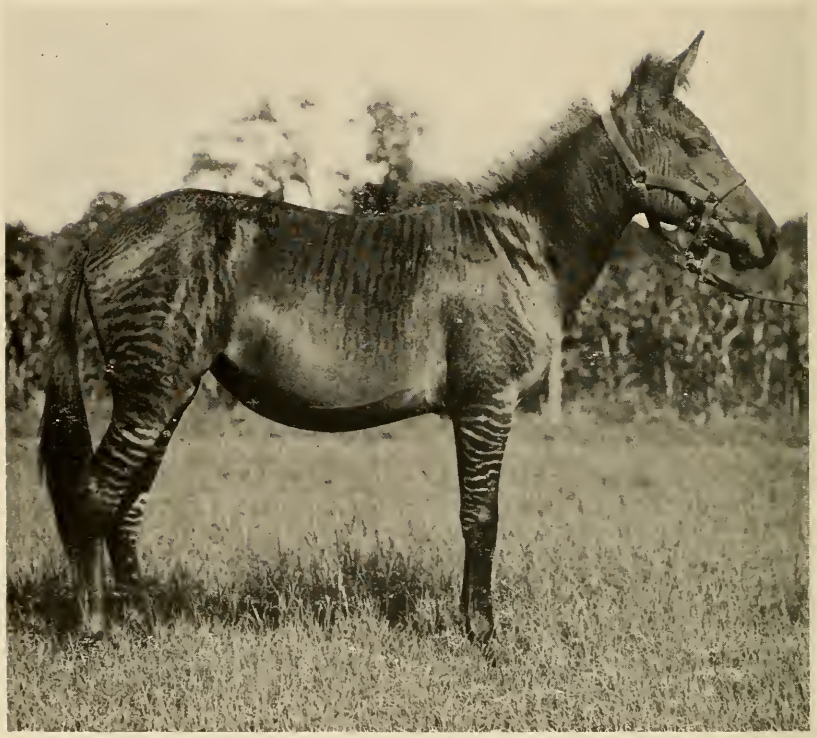
same stable. Jerry, the female zebra, the asses and the remaining hybrids were transferred from Bethesda to the experimental farm.

Jerry had been kept away from the female zebra and out of her sight as much as possible. He was a young animal when received, and we thought that he had probably never covered a female zebra and would therefore be more likely to cover a mare. To test his availability as a sire of mules, two young fillies were sent to Beltsville from the Morgan Horse Farm in the spring of 1911. They were Isabel, a three-year-old, and Baby Gates, a four-year-old, both registered Morgans; neither had been bred. These fillies were turned into a paddock with Jerry. He did not show Dan's antipathy to mares; in fact, the three became very good friends, but no mating resulted. The mares came in heat regularly and Jerry manifested a certain amount of sexual excitement. He would mount but, for some peculiar reason, would not complete the act.

After months of these trials without results, the female zebra was bred to Jerry; she had produced a foal which was dead at birth and we felt that we could not afford to lose the chance of getting a living foal from her. Whether breeding Jerry to a female zebra would cause him later to refuse to cover asses was of little consequence. The female was bred, and Jerry was then tried on the asses; strange to say, he covered them without objection. Why Jerry should refuse to cover mares when he had probably never mated with his own species, but would readily go to asses after he had mated with a female Grevy zebra, is a question in animal psychology the writer does not presume to answer. It should be mentioned that breeding Dan to the zebra female did not make him less ready to cover asses, but the first females Dan covered were asses and he was not put to a female zebra until over a year thereafter. In Jerry's case, his first mate was the female Grevy zebra. Here we may note a peculiar difference in temperament between Dan and Jerry. Dan absolutely refused to cover anything if a human being was within sight or hearing; an audience at this time is a matter of supreme indifference to Jerry.

The last zebra female died suddenly in August, 1911. Post mortem showed the cause of death to be impaction of the bowels, and the uterus contained a fetus about one month old.

Copulation being readily performed by the zebra with female donkeys, it was of course easy to collect semen to impregnate mares



JUNO, A ZEBRA-MARE HYBRID.

Foaled June 2, 1912, out of the registered Morgan mare Baby Gates, Vol. III, A. M. R.; sired by the Grevy zebra Jerry. Juno weighed 570 lbs. on September 12, 1913; her dam weighs 850 lbs. Compared with the zebra-ass hybrid, the neck is longer, more flexible and cleaner-cut, and the back more compact and shorter, while her disposition is also good. These characteristics make her more desirable for domestic use than the ass hybrid.

artificially. This was begun as soon as Dan began to cover the asses. The semen was collected in five c. c. gelatine capsules as soon as possible after service and a capsule inserted by hand into the uterus of the mare. One mare was got in foal in this manner while the work was at Bethesda and three at Beltsville. The first mare and one of the latter lost their hybrid foals, one of the latter was condemned and sold, having since foaled a zebra hybrid, by Jerry, and the fourth is the Morgan mare, Baby Gates, who foaled a female hybrid by Jerry on June 2, 1912.

It has been found that the zebra semen does not contain rela-

tively so many spermatozoa as that of the stallion, and this may account for much of the difficulty in breeding by artificial means. For several years, it was our custom, whenever a donkey was bred (which was frequently) to collect the semen, hobble all the mares and insert a capsule in each one. There were from five to ten mares on hand all the time and these mares were artificially bred many times a year. The mare which was sold was one of the most disappointing of all. She always appeared to be in foal some months after being "capsuled," but just as regularly proved not to be. When she was reported as in foal some weeks after her sale, it was believed to be a false alarm as usual, but subsequent events proved the contrary.

The first zebra mare hybrid was foaled in June, 1912. It is now being fed with young horses and in many respects is a promising animal. The ass hybrids do not appear to have much value as work animals. We have handled a number of them, and have one pair that worked regularly for some months, but they are decidedly stubborn and very hard-mouthed, which is not to be wondered at. When we consider the stubbornness of the donkey coupled with that of the zebra, which is as much, if not more, we can hardly expect an increase in docility and tractability in the resulting offspring. The ass hybrids are decidedly donkey-like in disposition and habits. When young, they trail along after their dams through the paddocks, no one in a hurry or in the least excited.

The mare hybrid, on the other hand, is more like a horse in appearance and manners. When a little thing she would always keep close to her dam, usually on the side away from the visitor, and in following her through the field would keep close up to her. She has the alert, spirited air of a mule which one would expect from a high-spirited, well-bred mare. Of course, the mare hybrid is yet too young to determine what sort of a work animal she will become.

The Grevy zebra has one characteristic, which, in our opinion, in the absence of any other would make it of value for mule production. It is a highly-finished animal,—an animal "with lots of quality," as the stockman would say. In breeding mules from jacks the farmer depends on the mare for finish and quality. With the Grevy zebra he gets it from the sire as well. Therefore, it would appear possible to breed a finer class of mules from the Grevy zebra than from jacks, using all kinds of mares, fine, medium and

SHOWS NO TRACE OF "SATURATION."

Registered Morgan filly Georgia, Vol. IV, A. M. R., by Pat Murphy; dam Baby Gates, Vol. III, A. M. R., by General Gates (666); foaled May 14, 1913; photographed September 4, 1913. Although the previous foal of her dam was by a zebra, Georgia shows no trace of the influence of this previous impregnation—an influence which has been claimed by many to exist, and is called telegony. Georgia is thin; apparent stripes are merely the ribs.

coarse. It is not to be doubted that the size of the Grevy zebra can be considerably increased by selection and feeding, once sufficient numbers are gathered together under the conditions of domestic animal life.

No one need fear that the Grevy zebra can not be handled under farm conditions. He is now to be classed as a wild animal, of course, but so is the elephant until man captures him. Our Grevy zebras have been no more difficult to handle than stallions or jacks. They are stubborn; so is a jack. They may be made vicious by improper and vicious handling; so may a stallion or jack. The

zebra is not a child's toy, but neither is he a savage wild animal, absolutely without amenability to the control of man. The Grevy zebra is susceptible to domestication, and a thorough trial of his possibilities is well worth while.

Every one is familiar with Ewart's classic experiments in telegony, where he used the Burchell zebra and small mares of pony type. These investigations seem to prove conclusively that the influence of one impregnation of a female has little, if any, effect on the characteristics of subsequent progeny.* In our work it was possible to confirm that of Ewart. The mare, Baby Gates, had never been bred until she was artificially impregnated with zebra semen. Her first foal was the female hybrid, Juno, by the Grevy zebra, Jerry, born June 2, 1912. At the first period of heat she was bred to the registered Morgan stallion, Pat Murphy, and foaled the filly Georgia on May 14, 1913. This foal shows no evidence in any particular of the influence of the zebra impregnation. It is strongly like its sire, and promises to develop into a handsome, stylish mare. In some of Ewart's cases, stripes have been apparent at birth, but these disappeared subsequently, and Ewart believes their presence to be due to reversion to an ancient horse type and not to telegony. As stripes are frequent among the pony stock of northern Europe, his explanation seems to be correct. Stripes are common among mules in the United States, but rare among horses or ponies. The complete absence of stripes as a result of reversion in the filly Georgia was to be expected.

It is also interesting to note that Baby Gates was a twin. The other, a male, was dead at birth. Baby Gates was very weak when born and weighed only 42 pounds (less than half the normal birth-weight for Morgan foals), but hot blankets and careful nursing saved her. Twin foals are unusual and are rarely raised. It should also be noted that Baby Gates is what cattle breeders call a "free-martin"—twinned with a male—yet she produces readily. Some cattle breeders believe that free-martin heifers are sterile, although the cattle herd books abundantly disprove it. The case of Baby Gates indicates that "free-martin fillies," if we may use the term, will also breed.

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* "The Penycuik Experiments," by J. Cossar Ewart; A. & C. Black, London, 1899.

"Guide to the Zebra-Hybrids, Etc." by J. Cossar Ewart; T. & A. Constable, Edinburgh, 1900.

A ZEBRA-ASS HYBRID.

This cross is made without much difficulty but promises no commercial value because of the stubbornness of the animal—a characteristic to be expected, since it inherits stubbornness both from its zebra sire (Dan) and its burro mother. Its stripes show more plainly than do those of the mare hybrid because its coat is lighter in color, although the body color resembles that of the dam in both cases.

A number of cases have been recently reported, alleged to be instances of fertility in ass-mare hybrids,—common mules. It is apparently true that mare mules may secrete milk, but the milk-secreting function is not an infallible sign of maternity. It may be stimulated by artificial manipulation of the glands, and cases are said to be on record of the stimulation of milk secretion in males by manipulation of the rudimentary milk glands. Oestrum in females and sexual activity in entire males are usual in mules; neither phenomenon appears to be an absolute indication of fertility. However, it is a fair supposition that where nature has endowed animals with these phenomena, the possibility to reproduce may be present

and reproduction may occur. The fact that mules are not used for breeding puts a large number of chances against the probability of mules producing. If a large number of mules were experimented with, perhaps in time a fertile one might be found. However, the writer craves the privilege to question the accuracy of the accounts of this alleged occurrence which have been thus far noted. When the man who actually bred the mare mule is heard from, and likewise the man who was actually present when she foaled, his skepticism will be removed. At present there is always a weak point in the chain of evidence,—a point where the chain must be pieced together with supposition.

Our zebra-ass hybrids, both male and female, give every visible indication of sexual activity. They have been bred together; the females have been bred to Jerry (the Grevy zebra), and the males have been bred to donkey females. This has been done, not once or twice, but dozens of times, and by natural means. No foals have resulted, and none of the females are now pregnant, so far as we can observe. It would appear that the relationship between a zebra and a common ass is closer than that between the ass and the horse. Therefore, the possibility of fertility in a zebra hybrid would seem greater than that in common mules. Perhaps when larger numbers of zebra hybrids are available and more attempts are made with common mules, an undoubtedly fertile zebra hybrid or mule may be found.

In the absence of funds for the purpose, the Bureau is not planning to continue the work with the Grevy zebra. While we have been unable to mate the male zebra direct with mares, it does not appear to be impossible, in view of Ewart's experience with the Burchell zebra. We have made the cross with mares, which has given us a promising animal, and there seems to be no reason to think that the Grevy zebra would not be valuable as a farm animal if properly handled from birth.

THE EUGENICS OF WAR

Its Effect Principally on Heredity, and Wholly Pernicious—Military Training Cannot Compensate Because It Has No Effect on the Germ Plasm*

DAVID STARR JORDAN

Chancellor of Leland Stanford Junior University, California

The final argument against war and against all those accessories of war which, in the name of peace, invite war, is found in its effect on the breed of men. The destruction of the strong means the perpetuation of the weak. The loss of the bold, dashing and courageous means the rule of the cautious, the timid, the time-serving.

The waste of money in war and in armed peace, without parallel in the history of the world, "the endless caravan of ciphers" representing war debt and war expenditures, the earnings of poor men's lives spent in futile murder or in equally futile preparation for it, is but a small part of the toll exacted by war. The greatest waste of all is that of life itself. It is a well-established fact of biology that the laws in heredity which apply to man are those which govern the lower animals as well. "Like the seed is the harvest"—that is the fundamental law. The men you breed from determine the future.

Heredity runs level. No race of men nor animals has improved save through selection of the best for parentage. None has fallen save through the choice of inferior stock for parentage. Whatever influence may cause the destruction of the strong, the brave, the courageous, the enterprising, will ensure a generation which shall show these qualities in lower degree. Rome fell because the old Roman stock was for the most part banished or exterminated. There was no other cause. The Romans were gone and that was the end of it; while the sons of slaves, camp-followers, scullions, and peddlers filled the Eternal City. The republic fell when "Vir gave place to Homo," real men in Rome to mere beings. The em-

* Address recently delivered in the home of the Duchess of Marlborough, London.

pire fell when the barbarians filled the unoccupied city, unoccupied so far as the men of the old Roman type were concerned.

The latest historian of the "Downfall of the Ancient World," Dr. Otto Seeck, of the University of Munster, tells us how, after the wars of Marius and Sulla, "only cowards remained, and from their brood came forward the new generations." We ask no other reason for the disappearance of Greece, Greek art, Greek philosophy, Greek literature, the perfection of form in thought, in action, in speech—all of these were impossible save to men of Greek blood; and when these had fallen in suicidal war, there was no longer the heredity which could replace them.

Some twenty years ago I visited the city of Novara, in Northern Italy. South of the town lies a wheat field, where the Sardinian army was once encamped and from which they were driven by the Austrians. A huge mound of human skulls tells the story. History tells the rest, but the significance of such events lies not in the fate of kings, nor does it lie in the fate of the men, nor yet in the waste of their lives, nor even in the sorrows of those who loved them. It is found in the effect upon the race.

But there are other piles and piles of skulls, none the less significant because the bones are buried. The walls of Paris tell their story—Metz, Worth and the slaughterfield of Sedan. Then we can trace our lines across Germany, Jena, Leipsig, Austerlitz—names called glorious in the history of the slaughter of young men—Lutzen, Bautzen, Ulm, Wagram, Hohenlinden. Let us pass them all to recall the grand army of Moscow, 600,000 men, the finest body of men that ever stood in line. Then let us recall the blasts of winter, the burning city, the lack of base of supplies, the hatred of the people of the invaded country. And after that let us see, with the historian, the pitiful retreat of the 20,000 men who remained of this great army. The historian tells us that:

"Amidst ever deepening misery they struggled on, until of the 600,000 men who had proudly crossed the Niemen for the conquest of Russia, only 20,000 famished, frost-bitten, unarmed spectres staggered across the bridge of Korno in the middle of December."

The inevitable result of the waste of vigorous life must be the loss to the nation of the qualities which are sought for in the soldier. It leaves the nation crippled, "une nation blessée." The effect does not appear in the effacement of art or science or creative imagina-

tion. Men who excel in these regards are not drawn by preference or by conscription to the life of the soldier.

Those who fall in war are the young men of the nation, men between the ages of eighteen and thirty-five; they are the men of courage, alertness, dash and recklessness, who value their lives as naught in the service of the nation. The men who are left are, for better and for worse, the reverse of all this, and it is they that determine what the future of the nation shall be. They hold its history in their grasp.

However noble, encouraging, inspiring the history of modern Europe may be, it is not the history we would have the right to expect from the development of its original elements.

All this applies not to one nation alone, nor to one group of nations, but in like degree to all nations that have sent forth their young men to the field of slaughter. As it was with Greece and Rome, with France and Spain, with Korea and Turkestan, with Morroco and with Paraguay, so has it been with Germany and England; so with all nations that have sent forth "the best they breed" to foreign service, while retaining cautious, thrifty mediocrity to fill up the ranks at home.

Four millions of men fell in Napoleon's campaigns. No wonder the life of Europe is impoverished. No wonder that France is a wounded union, as are all others whose men were caught up in that holocaust. Napoleon, it was said, "has peopled hell with the élite of Europe." Stacked up on the field, as at Novara, their skulls would make a pile twenty-five times as high as the tallest spire in Europe. To this cause of reversed selection almost alone we may ascribe the social and personal deficiencies of the common folk of Europe. To be "him that overcometh" one must have a lineage made up of those who were "captains of their fate" and "masters of their soul in their day and generation." If we send forth the best we breed, there is no way in which those of the future shall be other than second best.

In his charming studies of "Feudal and Modern Japan," Arthur Knapp mentions again and again the great marvel of Japan's military prowess, as shown in the Chinese war, after more than two hundred years of peace. It has been even more conclusively shown in the Russo-Japanese war since Mr. Knapp's book was written. His astonishment was that after more than six generations in which military drill was not the final aim of each young

man, the virile qualities of patience and courage were found unimpaired.

If after two hundred years or even twenty years of incessant battle Japan should remain virile and warlike, that would, indeed, be a marvel. But that marvel the world has never seen. It is doubtless true that military traditions and the physical strength to gain victories frequently engaged in war, but military traditions and the physical strength to gain victories are very different. Other things equal, the nations which, like Japan, have known the "old peace with velvet-sandaled feet" are most likely to develop the "strong battalions" on which victory in war is most likely to rest.

What now of Germany? She has had her share of the desolation and the degradations of war. It is said that in the Thirty Years' War the population of Germany was cut down from 16,000,000 to 6,000,000 people. It is said that not before 1879 was Germany able to regain the ground she held in 1618. It is, moreover, claimed that while Germany is military, she is not warlike. While there is no nation so dominated by the professional soldier with his mediaeval scorn of commerce, science and all civilian things, yet there is virtually not a man in the German army who ever saw a battle. The superiority of Germany lies in its science, its industrial art, its commerce, its intensification of civilian activities.

The evidence of the havoc of war is not so clear in Germany as in most other lands of Europe. Perhaps, as Dr. Seeck affirms, massacre and desolation destroyed the weak as often as the strong. Perhaps again the fact of universal compulsory education and compulsory industrial training, with compulsory insurance against old age, has greatly reduced the visible number of the unemployed and of the unemployable.

The factor of emigration which has filled the great cities of the new world with young Germans, ambitious and energetic, is one which we cannot estimate in comparison with the effects of war. When the best emigrate, the home lands become impoverished, but emigration gives new ideas and new experiences. The loss of one region is the gain of another, and the gain with good men overbalances the loss. The men of the New World are Old World men who have learned something in a new environment, lost something, perhaps, in exchange for all that is gained, but in the long

run the new advantages outweigh the old. But loss which is loss comes from the sacrifice of the strong.

What shall we say of England and of her place in the history of war? In the Norse mythology, it was the Mitgard Serpent which reached around the world, swallowed its own tail and held the world together. England has been this Mitgard Serpent. She has held the earth together. She has made this a British world. Her young men have gone to all regions where free men can live. They have built up free institutions which rest on co-operation and compromise. She has carried the British peace to all barbarous lands and she has made it possible for civilized men in security to trade and pray the world over. "What does he know of England who only England knows!" For the activities of Englishmen have been manifold, greater without than within the little island from which Englishmen set forth to inherit the earth.

What has all this cost? It could not be done unless it was paid for, and we must not wonder if such strenuous effort, such sacrifice of life and force, has left her with a certain degree of exhaustion. It may have been worth the cost. This we are not questioning. But it is well to realize that the cost has been tremendous.

"There's a widow in Sleepy Chester,
Who mourns her only son.
There's a grave by the Prabang river,
A grave which the Burmans shun."

If we would know why Chester is sleepy, we have only to turn to her great cathedral. The long north side of her red sandstone walls tells of her dead, the world over, and always the same story. Tablets to the memory of young men, gentlemen's sons from Eton and Rugby and Winchester and Harrow, scholars from Oxford and Cambridge, from Manchester and Birmingham and Liverpool, who have given up their lives in some petty war in some far-off country. Their bodies rest in India, in Zululand, on the Gold Coast, the Transvaal. In England only are they remembered, men who should have been the makers of empire.

These names are recorded in every cathedral, in every parish church, and the churches of England are numbered by the thousand.

The foreign service of England for a hundred years has furnished careers for the sons of the squire and the gentleman. For

a century Great Britain has sent her strongest and most forceful sons. "Send forth the best ye breed," and the nation breeds from the second best.

And in this loss of fair and strong, "the unreturning brave," we may find an answer to some of England's most desperate problems.

Why is it that three or four, or may be ten millions, of Englishmen are unable to earn a decent living, or any living at all, in England today? Why is it that these same unemployed are found unemployed in Canada, in Australia, or wherever they may go? Why is it that the tendency in all average physical standards is downward, while the standards of the best are growing always higher? The answer lies in the reversed selection of war. Its effects are found in England and everywhere else where strength and courage have been rewarded by glory and extinction. England has exchanged her country squires for the memorial tablet. More than for all who have fallen in battle, or were wasted in the camps, England should mourn "the fair women and brave men" that should have been descendants of her strong and manly men. If we may personify the spirit of the nation, England should most grieve, not over her unreturning brave, but over those who might have been but never were, those who so long as history lasts can never be.

"The best ye breed!" is war's insatiable call. Send your best, your fittest, your most courageous, your youths of patriotism and your men of loyal worth, send them all and breed your next generation from war's unfit remainder. Do that, as Scotland has done it, and what says your biology? Like father, like son. Like seed, like harvest. You cannot breed a Clydesdale from a cayuse, neither can the weakling remnant of a war nation breed a new generation of heroes for a new generation's wars.

But, we are told, war ennobles the nation. Did the British wars that drew 22,000 soldiers from the Isle of Skye ennoble the landlords who drove from their lands the very families that bred these men? Did the heroism of the Grants from Strathspey and Glenurquhart, and the deathless devotion of the clansmen from Kildonan and a hundred other glens, who saved the honor of the race at Lucknow and Cawnpore—did that awful slaughter ennoble the dukes and earls and lords who during that immortal sacrifice of the sons drove the fathers from the crofts and burned the sheillings where they were born?

By a strange confusion of cause and effect it has been assumed in some quarters that the waste of virility from war could be repaired by universal military drill. Assuming that such discipline gives increased physical and mental vigor, that fact would not appear in heredity—no training can raise a man above his possibilities, and it is the possibilities only that his children inherit.

The events in a man's life leave no trace in real heredity, and none in transmission except as the events may impair the vigor of germ cells. Moreover, we who believe in the value of sound physical training to the growing youth cannot admit that barrack life comes under this head, or that it is in any important degree a substitute for it. The drill assigned to the soldier comes too late in life to be of much value. It is narrow and limited in kind, with a sinister purpose behind it. It is under incompetent teachers to whom physical training is only an incident, not a means nor an end.

The camp is always a school of idleness, and usually of vice also. It interferes with the industrial or professional training which should be a duty of every young man to acquire. Moreover, if compulsory, all these evils are intensified. There is value in drill and in discipline. When these are voluntarily assumed they have large possibilities. But compulsory military service bears the same relation to the drill in competent schools that stoking a furnace bears to building one's camp fire in the forest.

In any event, this whole matter belongs among the problems of education and not at all to those of eugenics, with which lies the preservation of race-strength. By the law of probabilities as developed by Quetelet, it is claimed that there will appear in each generation the same number of potential poets, artists, inventors, patriots, athletes, rogues, superior and inferior men of each degree.

This law, however, involves the continuality of paternity, that in each generation a practically equal percentage of men of superior mentality will survive to take the responsibilities of parenthood. Otherwise this law becomes subject to the action of another law, that of reversed selection, or the biological law of "diminishing returns," as Quetelet himself indicated. In other words, breeding from an inferior stock brings race degeneration, and such breeding is the sole agency of such degeneration, as selection, natural or artificial, along one line or another is the sole agency for race progress. And all laws of probabilities and averages are subject to a still higher law, the primal law of biology, which no cross-

current of life can check or modify: Like the seed is the harvest; almost alike but never quite, but on the whole always following the lead. There is in fact no law save this: Under like conditions heredity runs alike, almost alike, but with like variations. When conditions change, so change the products of heredity.

What shall we say of America, with her years of peace, and her two great civil wars, the struggle of children with their parents, of brothers with brothers?

It may be that war is sometimes justified. It is sometimes inevitable, whether necessary or not. It has happened once in our history, that "every drop of blood drawn by the lash must be drawn again by the sword."

It cost us 650,000 lives of young men to get rid of slavery. I saw not long ago in Maryland one hundred and fifty acres of these young men. There are some 12,000 acres filled with them on the fields of the South. And this number, almost a million, North and South, was the best that the nation could bring. North and South alike, the men were in dead earnest, each believing that his view of state rights and of national authority was founded on a solid rock of righteousness and fair play. North and South, the nation was impoverished by the loss. The gaps they left are filled to all appearance. There are relatively few of us left today in whose hearts the scars of forty years ago are still unhealed. But a new generation has grown of men and women born since the war. They have taken the nation's problems into their hands; but theirs are hands not so strong or so clean as though the men that are stood shoulder to shoulder with the men that might have been. The men that died in "the weary time" had better stuff in them than the father of the average man of today.

Those states which lost most of their strong young blood, as Virginia, Louisiana, the Carolinas, will not gain the ground they lost, not for centuries, perhaps never.

THE KAFIR ORANGE

An Edible Member of the Strychnine-Producing Genus Which Succeeds in the United States—Numerous Relatives Also Promising for Tests by Plant Breeders

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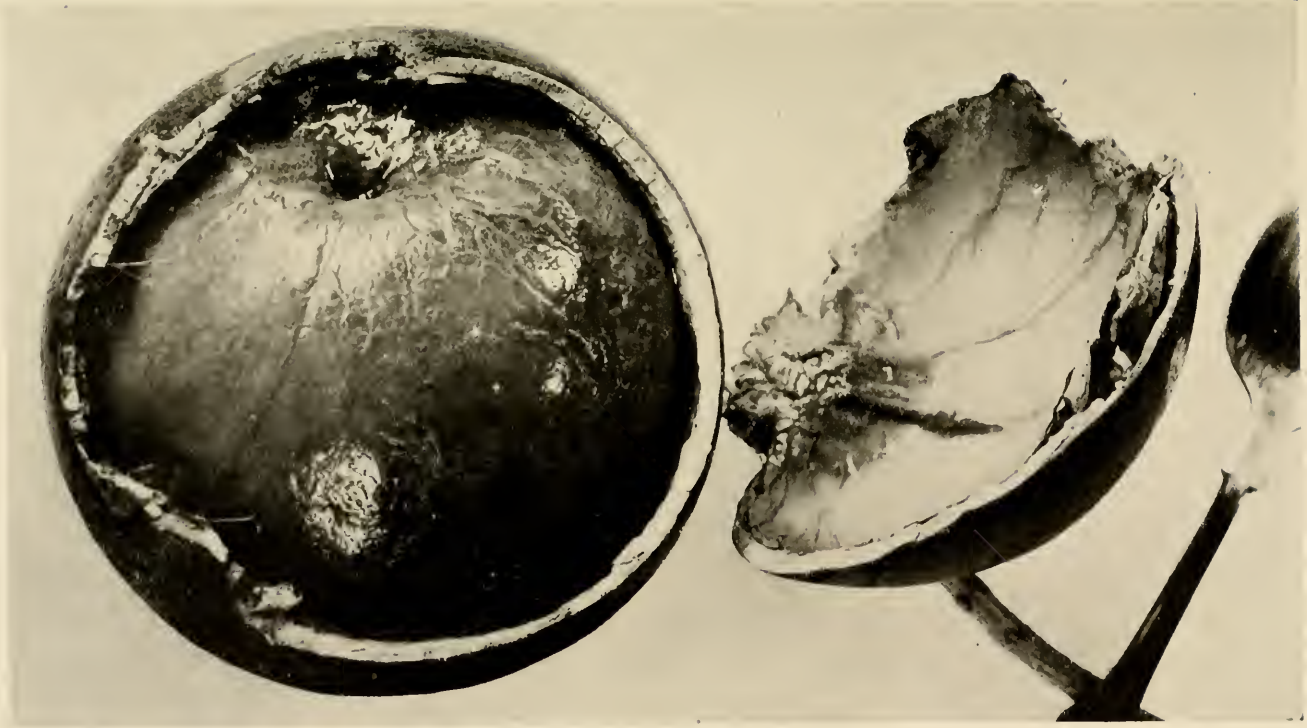
Ten years ago, while I was traveling with Mr. Barbour Lathrop down the east coast of Africa, the American Consul at Delagoa Bay, Mr. Hollis, gave us, just as we were embarking for Cape Town, a strange fruit, about the size and shape of a small cannon ball. He remarked that it was known as the Kafir orange and was considered good to eat, but that the seeds were extremely poisonous. As the fruit appeared to be green, I threw it into the rack over my bunk, in the hope that it would ripen. In a day or two I began to be conscious of an agreeable, spicy perfume which pervaded my cabin, and I traced it to this Kafir orange. Thinking the fruit must be ripe, I tried to open it, but discovered that the shell was too hard to be cut with a knife, and that it required the sharp blow of a hatchet to open it. Not knowing whether the fruit was ripe, and remembering the reputed poisonous character of the seeds, we hesitated to more than taste the fruit, but its singularly spicy aroma and sweet flavor were attractive enough to induce us to send the seeds to America, with a brief account of our experience with the fruit. These seeds arrived in Washington May 6, 1903, were identified as the seeds of *Strychnos spinosa*, Lam., were given F. S. P. Introduction No. 9611, and twelve of them sent to the Miami, Florida, Plant Introduction Field Station the next day.

Nothing further was reported regarding this new plant immigrant until 1906, when a specimen four and one-half feet tall, standing on the station ground, was reported as having had its lower leaves and branches killed by a temperature of 20° F. on Christmas day of that year.



THE SWEET, PERFUMED KAFIR ORANGE.

This cannon-ball-like fruit is a member of the family which produces strychnine, and its own seeds contain small amounts of that drug; yet its sweet, aromatic flesh is widely eaten by the natives of East Africa. It has been grown both in California and Florida and has proved fairly hardy; it offers plant breeders an opportunity to produce a unique fruit which, Mr. Fairchild says, is worthy of use to perfume clean clothes, just as the Chinese use their scented quinces.

In 1909 the plant began to fruit and has continued to produce each year a considerable number of these remarkable cannon-ball-like fruits.

Seedlings of this tree have been distributed in northern Florida and southern California and are now growing there.

I cannot deny that these fruits have always had a peculiar fascination for me. They are so perfectly round that one could almost play croquet with them, the shell being as thick as, or thicker than, that of a calabash. The interior of the fruit is filled with a mass of brown pulp having a ripe banana flavor, with a strong spiciness suggestive of cloves. It has always been interesting to watch the development of the aroma in this fruit as it ripens and changes in color from a brilliant green to a straw-yellow. The Chinese grow a special variety of quince and put the fruits among their clean clothes, and keep them in their dwelling-rooms, because of their delicate perfume, but, personally, I feel like adopting the Kafir orange as my room perfumer. Imbedded in the pulp are a number of large, hard, flat seeds that remind one of the lucky stones of the seashore, said to be the ear bones of some fish. These, it is reported, are extremely poisonous, but an analysis made by Dr. Rodney True, of the Department of Agriculture, failed to discover more than a trace of strychnine in them. It is the *Strychnos nux-vomica* of India which furnishes this extremely poisonous drug.

There is a fascination, too, in the behavior of the shrub—something suggestive of antiquity. The young branches when they form are as tender as an asparagus shoot, and the new growth, which consists of long, pendulous branches, forms quickly in early spring and later falls over and becomes semi-pendulous.

The fact that this East African *Strychnos*, although a totally wild fruit, has shown itself capable of living and bearing in Florida, and has even lived through temperatures which have killed orange and lemon trees in California, makes it worthy of consideration in itself. It is only, however, when we come to investigate its relationships that the problem presented by this Kafir orange appears in its proper proportions.

The literature informs us that there are a hundred species scattered through the tropics of both hemispheres, and though the fruits of many of these are still quite unknown—and of the remainder nobody seems ever to have tasted many—at least eight are known

THE KAFIR ORANGE TREE AT MIAMI, FLORIDA.

This *Strychnos spinosa* is closely related to *Strychnos nux-vomica*, which produces the strychnine of commerce; there are nearly a hundred species in the genus, most of which contain strychnine in the seeds, although the flesh is edible. Despite the fact that they are mostly natives of tropical regions, they promise to succeed in favored parts of the United States. With a little improvement through hybridization and selection, they offer a number of unique fruits to American growers.

to bear edible fruits ranging in size from that of a cherry to that of a cannon-ball five inches in diameter.

In *Flora Capensis* published in 1909 a remark regarding the edible character of one of these species is to be found: *Strychnos dysophylla,* Benth., produces a "globose, black berry, sweet, well-tasted, according to Baines, who found it on the red sand flats to the west of Blueberg and Hanglip Mountains, south of the Limpopo River.[1]"

Gilg and Busse, in their paper on the German East Africa species[2] of Strychnos, state that these East African species are characterized by an unusual fruitfulness and that most of them seem not to be poisonous, and that the natives are known to eat the fruits of *S. tonga, S. quaqua, S. behrensiana, S. goetzei and S. euryphylla.*

Strychnos tonga, Gilg, is an erect tree which bears globose fruits three and one-half to four inches in diameter, having a thick shell like *Strychnos spinosa.* Its large seeds are imbedded in a copious pulp. It occurs in the Mozambique District, German East Africa, at Pangani and in Portuguese East Africa at Quilimane.

Strychnos quaqua, Gilg, has been found at Quilimane in Portuguese East Africa and on the border between North Unguru and Useguha at Kwediboma. Although still imperfectly known, it appears to be an erect shrub, twenty-five feet high, with pendant branches. It was in fruit in September, and the fruit is reported to be edible, though nothing has been reported as to the size of this fruit.

Strychnos behrensiana, Gilg and Busse, is the commonest species of the genus in the coastal region of German East Africa. It is a small, scraggly tree, twenty-five feet high. It occurs on the Tongue Mountain near Pangani, where it was found in bloom in December, at Sachsenwald near Dar-es-Salaam, where it was in fruit in May, and between Msenga and Mafisi (Usaramo) and at Kilossa. Its native name in the Kiswahili language is *"Mtonga."* The large, warty fruits, three to four inches in diameter, are faded grey-green in color, and the slimy, sweet-tasting, orange-colored pulp is eaten by the natives and devoured by the wild swine and apes.

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[1] Thistleton-Dyer, Sir William, Flora Capensis, Lovell-Reene & Co., 1909, p. 1054.

[2] Gilg, E. und Busse, W. Die Von W. Busse in Deutsch-Ost Afrika Gesammelten Strychnos-Arten. Botanische Jahrbücher für Systematik Pflanzen-Geschichte und Pflanzengeographie von A. Engler, XXIII Bd., 1903, pp. 173-181.

Strychnos goetzei, Gilg, is an erect shrub, six feet or so high, bearing smooth, thick-shelled, globose fruits, two to three inches in diameter, and containing a copious pulp, which is reported to be edible. It occurs in East Ungoni and is called by the Kingoni natives, "Mgese," and also at Uhehe, Uchungwe Mountains, at an altitude of 5,000 to 6,000 feet.

Strychnos euryphylla, Gilg and Busse, is a small tree, twenty-five feet high, which occurs in the foothills and highlands of the interior of German East Africa at Uluguru; Ungoni Highlands near Kwa-Lituno, where it was in fruit in June and August; Kiroka and Usagara. The fruits are two and one-half to three inches in diameter, with a thick pericarp, and are reported not to be poisonous.

Baker reports that *Strychnos xerophila,* Baker, from Jur: Kurshook Ali's Seriba, has fruits the size of an orange, which are full of pulp and edible, and that *Strychnos burtoni* from Zanguebar, Lower Zambesi, Shupanga, and the valley of the River Shire bears fruits two and one-half to three inches in diameter with edible pulp and large, orbicular, flattened seeds that are roasted and eaten.

Of the South American species and those in other parts of the tropics little information is obtainable regarding the edible character of their fruits. It seems quite natural that as soon as a botanist discovered the genus to which one of these plants belonged he would suspect it at once of being poisonous, because of its relation with *Strychnos nux-vomica.* Enough is now known, however, about them to make the suggestion worth while that some one who is looking for a problem in plant breeding should get together as many representatives as possible in an arboretum collection in the tropics, or on the edge of them, and begin the work of improving this remarkable class of fruits.

The Office of Foreign Seed and Plant Introduction has already introduced several different forms and is searching for others, and would like to get in touch with any amateurs who are interested in the possibilities of improving this class of tropical fruits.

SEX-LIMITED INHERITANCE

Relative Influence of the Two Parents on the Offspring—The Heredity of Colors—Practical Breeding Rules*

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Breeders of animals have long held to the idea that the two parents contribute different characters to the offspring, or at least that the sire has a preponderating influence on certain characters while the dam is chiefly responsible for others. In the present paper it is proposed to discuss what scientific basis there is for such a belief in the light of our present knowledge.

The revolutionary effect of Mendel's work on peas has so often been pointed out that there is no need to emphasize it further. But it has a distinct bearing on the question we have under consideration, for Mendel found in the case of all the characters with which he worked that it was the nature of the *character itself* which determined the appearance of the offspring in this respect, and not a question of which parent possessed that character. Thus if a tall pea and a short one were crossed, the resulting offspring resembled in this respect the tall parent, regardless of whether that parent was the mother or father plant. So with the color of the peas, the color of the unripe pods, and all the others of the seven pairs of characters with which he worked; in each case the same one of the characters was dominant over the others in the offspring, regardless of which parent supplied that character to its makeup. When Mendel's work was revived and experiments of a similar nature began to be made on a large number of animals and plants, similar results were obtained, and scientists generally came to believe that it was a matter of indifference which parent supplied a particular character, for the character appeared or not in the offspring entirely according to whether or not it was dominant or recessive to its alternative condition in the other parent.

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* Paper read at the Ninth Annual Meeting of the American Breeders' Association, Columbia, South Carolina, Jan. 25, 1913.

But it was not long before discordant results began to appear. Cases were found in which the ordinary sequence of events followed when one of the parents possessed the dominant character—it appeared in all the offspring; but when the same character was supplied by the other parent a different result was obtained. In this case it was found that about half of the offspring showed the dominant character while the other half lacked it. Furthermore, the remarkable relationship appeared that those offspring showing the character were of one sex, while those lacking it were of the opposite sex. In fact, this sort of inheritance has come to be called "criss-cross inheritance" from the fact that those offspring lacking the character were of the same sex as the parent which supplied it, while those having the character agreed in sex with parent which did not possess it.

An example will help to bring the relationship out more clearly. It was first worked out definitely in the case of the Currant Moth (*Abraxas*), where the ordinary dark type (*A. grossulariata*) is dominant to the lighter form (*A. lacticolor*). But for convenience I shall select an example from my own breeding work with pigeons. There are three colors known to the pigeon fancier which we may call primary. These are black, blue and red. But they do not exhibit this appearance unless there is present some factor which makes them *intense* in coloration. In the absence of this factor for intense, black appears as a dilute black or dun, blue as a dilute blue or silver, and red as a dilute red, called by the fancier yellow or cream. The "intense" factor behaves precisely the same way in inheritance with whatever color or colors it may be associated, so for convenience we may as well consider it only in relation to black. We are thus concerned with the two colors black and dun, and we shall consider that all the birds used as parents are of pure breeding. The outcome of mating a black male to a dun female is entirely in accord with ordinary Mendelian results, as follows:

Black male × dun female: Offspring = all black.

But the reverse cross gives an entirely different result:

Dun male × black female: Offspring = males, black; females, dun.

In this case, in other words, the male offspring are like their mother and the female offspring like their father. Does this not

have a familiar sound to the breeder? Have we not often heard the breeder unfamiliar with Mendelism lay down the principle that "daughters take after their sires, while sons resemble their dams?" While we have found this to be true only when the cross is made in one direction, nevertheless the breeder has undoubtedly in many cases dimly discerned a half-truth, and we would do well to examine such cases further in order to see whether they will fall into line with the principles of sex-limited inheritance, as it is called, which have been outlined above.

Under certain conditions we may get results in some respects resembling these of sex-limited inheritance in the case of characters which really are inherited in simple Mendelian fashion. Let us take for example crosses between black pigeons and red ones. Both of these carry the factor for intensity, so that need not here be taken into consideration. If a pure (that is, duplex or homozygous) black be crossed with a homozygous red, all the F_1 offspring are black, owing to the dominance of this character, irrespective of the direction in which the cross is made, and in the second generation (F_2) segregation occurs in typical Mendelian fashion. But now suppose that instead of a homozygous black female the black we used had been heterozygous for that character, such for example as the females produced in F_1, which contain but a single dose of black, or in other words are simplex for that character. The black male bred to a red female would produce all black offspring. The result of breeding the red male to the heterozygous black female, however, would be equal numbers of black and red offspring, just as the dun male bred to the black female gave equal numbers of blacks and duns. The case of the reds is, however, different in one respect, namely, that in this case there is no constant relation between the color of the offspring and their sex—the blacks may be either male or female, and similarly the reds may be either sex—while in the other instance it will be recalled the blacks were all males and the duns all females. This is, however, enough to give us a suggestion that perhaps the female blacks were really heterozygous rather than homozygous after all. A similar assumption has been made as to sex, and if we further assume that the factors for sex and for intensity of pigmentation have a constant relation (that is, coupling or repulsion) in the germ cells, we have a theory which fits all the phenomena observed. There is no need to discuss the relation of these phenomena to the

behavior of the chromosomes, which is a matter of much interest but beyond our present purpose; it is enough to see that the breeding behavior of the pigeons indicates that all females are heterozygous for the factor for intensity, and that there is a constant relation between this factor and sex.

All of the sex-limited characters in poultry and other birds behave in inheritance as if the female were heterozygous with respect to such characters. The same is true of the known cases in *Lepidoptera*. In certain other insects, on the contrary, the breeding evidence points to the male as the heterozygous sex. This is true also in man and in the few cases in other mammals in which sex-limited inheritance has been identified.

The suggestion has already been made that certain phenomena observed by the practical breeder and attributed by him to some sort of association with sex, were in reality cases of sex-limited inheritance. And indeed similar references may be found in many of the works on breeding and heredity. This is especially true of cases of certain defects or pathologic conditions in man, such as color-blindness, hemophilia, and the like (*cf.*, for example, Darwin, Animals and Plants under Domestication, Vol. II., Chap. XIV.), which on later investigation seem clearly to be sex-limited in their inheritance. In these earlier works, however, there was failure to distinguish sharply between secondary sexual characters, those characters which properly belong only to one sex or the other and which depend upon the presence in the body of the sex gland for their full expression, and such characters as are now spoken of as sex-limited or sex-linked. These latter are distinguished by the fact that they may have equal expression in normal individuals of either sex, but when individuals possessing the character (in a duplex condition) are crossed one way with individuals lacking it, all the offspring are uniform in the possession of this character, while the opposite cross gives daughters like the male parent and sons like the mother in this respect.

There is another condition, entirely aside from sex-limited inheritance, which has often given rise to the idea of a differential influence of the sire and dam on the progeny. This is brought about by the method of breeding many of our domestic animals, in which only one male is kept to a large number of females. This increases greatly the individual importance of the male and leads to a much more vigorous selection of sires than of dams. Fur-

thermore the sire has many more progeny, from which his breeding powers may be judged, than is the case of any one dam, which again gives opportunity for closer selection in his case on this basis. For example, a Holstein bull heterozygous for black, would undoubtedly soon be detected from his getting occasional red calves and he would consequently in all probability be eliminated as a breeder. The chances of a heterozygous cow being bred to a heterozygous bull are consequently lessened greatly, so that the chances of her heterozygosis appearing are correspondingly reduced. Furthermore, even if she should throw a red calf, there is more reason for keeping her, especially if she is a paying producer, and less reason for disposing of her, since her influence on the breeding of the herd is much less than that of the bull. This process undoubtedly tends toward producing homozygosity of sires in horses, sheep, swine, etc., as well as in cattle. As a consequence the proportion of sires in these various animals, which are homozygous with respect to particular characters, is without doubt greater than it is in the dams, and this, especially when dominant characters are concerned, may very naturally lead to the conclusion that the sire has a greater influence than the dam on the offspring. The possibility of this fact has long been appreciated, though of course without its Mendelian interpretation. Thus Miles[1] quotes the following from an article by Dr. Allen Thompson on "Generation":

"The consequence of this has been that more attention has been paid to the blood or purity of race of the stallion, bull, ram and boar, than to that of the females; and hence it may be the case that these males more frequently transmit their qualities to the offspring than do the inferior females with which they are often made to breed. But this circumstance can scarcely be adduced as a proof that the male, *cæteris paribus,* influences the offspring more than the female" (p. 218).

He also gives (*loc. cit.*, pp. 219, 220) a quotation of similar import from Stonehenge's book on "The Horse." This principle was also recognized by Spencer[2] (*loc. cit.*, p. 22), at one time president of the Royal Agricultural Society of England, and he furthermore

[1] Miles, Manly, "Stock Breeding." New York, D. Appleton & Co., viii, 428 pp., 1907.

[2] Spencer, Earl, "On the Selection of Male Animals in the Breeding of Cattle and Sheep." Journ. Roy. Agr. Soc. Eng., Vol. 1, 1840, pp. 22-29.

emphasized the importance of judging a sire by its offspring. As pointed out above, this is the way in which heterozygous individuals may be detected. After stating (p. 24) that the breeder "should take care that the individual male animal which he uses shall possess the qualities which he requires," he adds: "In addition to this, it is of great importance that these qualities should have been characteristic of the family from which the animal is descended; and if he is old enough to have been the sire of any number of offspring, it is of a great deal more importance still that they should possess them; because all the perfections of shape and quality which the best judge may wish to find in a male animal are, after all, only indications of what the stock got by him will probably be: the seeing, therefore, what they really are is much more satisfactory."

In the light of our present knowledge we can go through the older works on breeding and heredity and find many references which we can now see referred to sex-limited inheritance. For example in a book on color breeding in pigeons we find the statement: "Another cross which may be resorted to if you cannot get a Silver cock—as, strange to say, invariably Silvers are hens—is to breed a Blue cock with a Silver hen" (p. 10[3]) and again (p. 13): "Silver has been little fancied by the fancier for several reasons: one is that 99 per cent of the Silvers bred have been hens." These statements, while perhaps not exact, become intelligible on the basis of the example which was given some time back, if we remember that silver is the dilute condition of blue just as dun is dilute black. In the same work to which reference has just been made we find (p. 3) the general rule laid down:

> "If you want type, get it from your hens—
> If you want color, get it from your cocks."

Going back again to the illustrative example, we note in that case that 75 per cent of the offspring were like their sire in color. This would surely be enough to give the breeder the impression that the male was chiefly responsible for determining the color of the offspring. As to type, it is rather doubtful whether the rule is here correct. Poultry breeders have a similar idea, but its truth is de-

[3] Chapman, E. R. B., "Color Breeding for the Pigeon Fancier and Amateur." Published by the author, 1911, 47 pp.

nied by many. If such is really the case, it cannot be accounted for by the laws which determine inheritance of color.

Among cattle breeders we find a prevailing impression that "the males of dairy-breeds, generally, are prepotent in the transmission of the characteristics of the females of their race" (Miles, *op. cit.*, p. 231). Sedgwick is quoted in the same place as saying: "It is well known, for example, that the supply of milk by cows is hereditarily influenced by the bulls rather than by the cows from which they are directly descended, and that the character of the secretion, as regards both the quantity and the quality of the milk, is chiefly derived from the paternal grandmother * * *."

This, if true, would fit in well with sex-limited inheritance, and such indeed it may ultimately be found to be. At any rate we should take advantage of all such suggestions, and give such matters thorough investigation. It would practically revolutionize the breeding of dairy cattle if the factor, or even some one of the factors, if there are several, which determine milk-production in cattle, could be found to obey any of the definite laws of Mendelian inheritance. The fact that the factors concerned in egg production of the fowl appear to have been so analyzed[4] should give us great encouragement in this matter.

Finally, just a word of warning should be said in this connection. Too many breeders are of the opinion that if any particular character of a sire appears in a large proportion of his miscellaneous progeny, it indicates a *general* prepotency on the part of that animal, other characters being assumed to be transmitted in the same way. We may pick up almost any book on animal breeding and find such statements as the following: "The galloways among cattle are noted for their prepotency. When crossed upon other breeds and especially upon grades, the progeny are nearly all black and hornless" (Shaw,[5] p. 99). It may be that galloways have other dominant characters as well, but we now know that these are undoubtedly independent of the polled condition and the black color. These would behave just the same if they were possessed in a homozygous condition by an animal of any other breed, or indeed by a grade or even a scrub.

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[4] Pearl, R., "The Mode of Inheritance of Fecundity in the Domestic Fowl." Journ. Exper. Zool., Vol. 13, No. 2, 1912, pp. 153-268.

[5] Shaw, Thomas, "Animal Breeding." New York, Orange Judd Company, 1909, xi + 406 pp.

In conclusion let me pay tribute to the observational powers of the practical breeder. He has seen many of these things, and Darwin in his books has gathered many of the breeders' observations into a mine of information. But without the key which Mendel gave us, anyone who sought an explanation for these phenomena was groping in the dark. Mendelism is beginning to unlock a few of the doors and to disclose the secrets hidden within, but a beginning has only just been made. It is enough, however, to stimulate both the practical breeder and the scientific student of heredity to further observation and experimentation, for but a short time ago we appeared to be facing a solid wall; all the doors appeared to be locked and barred, and we seemed to be making no progress in our attempts to force them open. Now the few rays of light let into the darkness beyond give us great hope for future discovery.

Association Matters

Members of the American Breeders Association will be interested to learn that Professor Willet M. Hays, principal founder of the association, formerly its secretary-treasurer, and its most active spirit until his health gave way last winter, has entirely recovered. He sailed for Buenos Aires on October 4, to accept a position in the Argentine government, superintending the establishment and organization of rural education—a subject in which he has always taken a deep interest. Professor Hays, who occupied the post of assistant secretary of the Department of Agriculture for many years, has a very wide circle of personal friends among the breeders of the United States, and all members of the association will wish him success in his new work.

As is noted on the inside back cover page of the magazine, the American Breeders Association has on hand at present copies of only a few of its own back numbers. There is a steady demand for other issues, to fill out sets, and the secretary will be glad to hear from any one who has duplicates or extra copies to exchange or dispose of.

According to a vote at the last annual meeting, the annual meeting of the association in 1915 will be held in connection with the Panama-Pacific Exposition at San Francisco.

A NEW FORAGE PLANT

Desmodium Hirtum, Recently Introduced, Promises to be of Value Both as Cover Crop and to Provide Fodder

Ad. Stolz
Mission of the Evangelical Brethren, Kyimbila, German East Africa

Among new plants of interest to breeders, high place must be given the interesting forage and cover legume, Desmodium hirtum, of German East Africa, which has been secured by the office of Foreign Seed and Plant Introduction, Bureau of Plant Industry, U. S. Department of Agriculture. Its introduction is due to the German missionary, Ad. Stolz, who gives the following account of it.

For three years I have carefully cultivated one of the native leguminous plants, *Desmodium hirtum* Guill. and Per., and have become convinced as to its value. With it I have planted *D. barbatum* Benth., a species probably known to Americans, since it is widely distributed in tropical America: it forms low clumps, has in part the same good qualities as *D. hirtum,* but does not grow so rankly and is now gradually overgrown by *D. hirtum.* The latter furthermore has the great recommendation that one can propagate it from rooted cuttings, and thus avoid a long wait to secure seed. If cuttings of one to one and one-half meters in length are used, the desired end can be quickly attained.

In its wild state, I have found this plant at elevations from 550 to 1,600 meters above sea level. It is a typical grass plant, with scanty growth and runner formation between the high grass haulms. I found it with a variety of other leguminous plants, of which our meadows produce abundance, and I tested all the species, but *Desmodium hirtum* turned out to be the best, showing great improvement under cultivation.

It is not to be underrated as forage, for asses and sheep eagerly eat the shoots. I anticipate that it will have great value as a combined cover and forage crop. Such cultures as coffee, tea, rubber, lianas and cedars, have taken on a significant fresh appearance

A NEW AFRICAN LEGUME.

The photograph shows native workmen of the Mission of the Evangelical Brethren at Kyimbila, German East Africa, planting shoots of *Desmodium hirtum*, one of the native leguminous forage plants, in a bed. The plant has recently been introduced to the United States where it will be tested not only for its value as a cover crop, enriching the soil by its apparatus for gathering nitrogen from the air and storing it in its roots, as all legumes do, but as a forage crop.

after having *D. hirtum* planted between the rows. This shows itself especially on this year's fresh, powerful shoots of the plants, hence the fertilizing value of this legume must be marked. It fertilizes not only other plants but itself, for where after a space of 12 months a spindling plant wanders through the soil, it raises itself in the following year to an entirely different, luxuriant plant.

On poor soil the shoots lie flat on the ground, reaching a height of two to five cm. On the other hand on good soils the shoots in the first year attain a height of 30 cm. The looser and better the soil is, so much quicker does it develop, and puts forth runners during a year, from one to one and one-half meters long, which quickly root in loose soil and form cuttings for transplanting. The accompanying photograph shows some of my assistants carrying such shoots and planting them in a bed. The plant can be easily grown from seed, too, but in doing so it is worth while, above all, to produce good, strong runners as quickly as possible which, so soon as they have rooted, should be planted during the rainy season, and will rapidly multiply. At first the land must be kept clear of weeds, but the plant will crowd out all weeds after it has once made a start. After seed production the plant dies down almost two-thirds from the rootstock, and the runners which have not dried up soon put forth fresh shoots which grow over the dead parts.

Eugenic Belief

Eugenic belief extends the function of philanthropy to future generations. It renders its action more prevailing than hitherto, by dealing with families and societies in their entirety, and it enforces the importance of the marriage covenant by directing serious attention to the probable quality of future offspring. It strongly forbids all forms of sentimental charity that are harmful to the race, while it greatly seeks opportunity for acts of personal kindness as some equivalent to the loss of what it forbids. It brings the tie of kinship into prominence and strongly encourages love in family and race. In brief, eugenics is a virile creed, full of hope, and appealing to many of the noblest feelings of our nature.—Francis Galton.

SELECTION IN PURE LINES

Fifty Years' Work in Wheat by Vilmorin Shows Not One of the Varieties Changed in Any Way by These Generations of Selection

Mrs. C. and Dr. A. L. Hagedoorn
University of Utrecht, Holland

The question whether genetic factors are constant or variable (factors, not characters) is one of the utmost importance to the practice of breeding as well as to science. As is observed by John Belling in a recent issue of The American Breeders' Magazine,* this can only be tested by selection-experiments with material pure for all its genetic factors. In plants such material theoretically is not to be found, as we can never be sure whether or not a plant is pure for such genetic factors as exert no influence on the development of the individual. And we know that several such factors must exist. But in practice, we know that a strain of plants, grown from one single individual by continued self-fertilization, must automatically become pure for all its genetic factors, if in each generation one single individual is taken to propagate the family. And this, even if the first individual were impure (heterozygous) for several genetic factors. Strains of habitually self-fertilized plants bred in this way can, therefore, for all practical purposes be taken for "pure lines." Johannsen showed that selection in such "pure lines" of beans, during several generations, had no effect.

Mr. Belling now observes that Johannsen possibly did not select plants, but seeds, which is quite another thing, and further, that possibly selection might have effect after a very much greater number of generations. There is something to be said for these objections. But if in reality selection can not modify genetic factors, then it ought not to be able to have any effect even in twenty or more generations on pure material.

Now, there happens to exist a series of selection-experiments in pure lines, which has been continued for half a century. Louis de

* Belling, John: Selection in Pure Lines. American Breeders' Magazine, Vol. III, No. 4.

AFTER HALF A CENTURY OF SELECTION.

Four pure lines of wheat, which have been bred by Vilmorin for 50 years. The original specimen in the seed museum is shown in each case at the left of the pair. At the right is a head of the same variety after it has been selected for half a century. The close similarity of the heads in each pair shows that selection has produced no change in these varieties—once the pure type is segregated it remains constant indefinitely.

Vilmorin, about 1840, started a living museum of pure lines of commercial wheats. Of each variety a single plant, the best, was selected in every generation, and this selection is continued even to this day. In plants with very long ears, the plant with the longest ears is selected, in branched-eared plants, that with the best branched ears, and so on. The seed of each variety sold each year by the firm of Vilmorin is derived from one single plant some generations back. It is the selection-principle reinvented several times by different breeders, amongst others by Nilsson in Svalöf some twelve years ago.

In 1911 Mr. Meunissier, the genetist of the firm of Vilmorin, found the collection of original ears of the varieties with which Louis de Vilmorin half a century back began his living museum. Some of these wheats are from the harvest of 1843, others date from 1850, or intermediate dates. Mr. Meunissier chose three dozen ears of varieties which are still in the collection, and which have therefore been bred continuously as pure lines for about fifty years. We compared these ears to ears of the 1911 harvest, and photographed them side by side. Some of these pairs of ears are here shown, each pair consisting of the old ear, and its descendant, half a century later. As can be easily seen from the photograph, all these generations of selection have not changed any one of the varieties one little bit. It can therefore safely be concluded from this series of experiments, that selection can have no effect in material pure for its genetic factors. Genetic factors are constant.

How then, it may be asked, is it possible that selection can modify almost any character of animals taken at random? The answer is obvious. Selection must necessarily have effect in material which is *not* pure in respect to the genetic factors it contains. Animal populations are nearly always impure for the most diverse genetic factors, even for such as give them their value commercially, and the absence of which makes them worthless. Thus, practically all the very best folds of sheep contain individuals heterozygous for the factor which distinguishes whites from blacks, and therefore produce occasionally a black, worthless lamb, and this, notwithstanding the fact that such lambs are never bred from in such races. Only by weeding out these heterozygotes, whenever they show themselves as such, can one gradually increase the proportion of homozygotes to heterozygotes. One of the best sheep-breeders in Holland is now doing this.

By severely inbreeding a family of animals (brother to sister, parent to child), even such a family must become pure for its genetic factors, for, every time two animals are mated, which both are pure for a given factor, or which both lack it, such an inbred family becomes absolutely and irreversibly pure in respect to this factor. Also, such breeding heightens the probability of bringing two such animals together. Even animals, therefore, may be bred pure. Possibly even some families of pigeons have thus already been rendered pure. It stands to reason, that if we want to know whether, by any chance, selection might be able to modify genetic factors of animals, even if it can not do so in plants, we must be sure that the material with which we start be as pure as the practically "pure lines" of plants.

We therefore challenge anyone, who believes that selection might modify genetic factors in animals, to start a selection-experiment with one brother and one sister, which have any character in the same grade; to breed the family severely in and in (brother to sister, parent to child), to change this character beyond the range of its modifications, *and then to bring it back to its starting point.*

For it is obvious, that it may be possible by selection to get rid of such genetic factors as influence the character selected in a direction opposite to that, in which we want to modify it, and thus to make great progress. On the contrary, if selection really might change genetic factors, modification of any character would be as easy in one direction as in the other.

It would, of course, be hopeless to work over all instances which are said to prove the possibility of a modification of genetic factors by selection. As far as we know, such experiments have always been made with hopelessly impure material, or rather with material which offers not the slightest guarantee of genetic purity. No case ought to be considered seriously, in which the material is not nearly as pure as it can possibly be made, for instance by long-continued strict inbreeding.

Only if our challenge can be successfully answered, will it become necessary to assume the possibility of a variability of genetic factors.

"AN EDIBLE OSAGE ORANGE"

Chinese Cudrania, Closely Allied to Common Mock Orange, Promises to be Valuable if Its Size Can be Increased by Hybridization

One of the most interesting but little-known Chinese fruits which has been introduced to the United States during recent years is *Cudrania tricuspidata,* a representative of the natural order Moraceae and closely allied to the Osage Orange of the Middle West. Its fruit, although small (one to one and one-half inches in diameter), is sweet and eatable, and because of its hardiness the shrub can probably be grown throughout the southern half of the United States. If successfully crossed with the Osage Orange, the progeny offers promise of being a source of food for live stock in a wider region, while selection of the fruit itself should result in the establishment of a variety that would be well worthy of cultivation for its fruits.

The first introduction was made by E. H. Wilson, of the Arnold Arboretum, Boston, who secured the tree in Central China, where it is known as Che. More recently Frank N. Meyer, agricultural explorer of the Bureau of Plant Industry, U. S. Department of Agriculture, at Washington, has sent it in from Laoling in the province of Shantung, where it is called Tcho Sang, "wild mulberry." "It is a wild shrub," he reports, "sometimes growing into a small tree, and found in dry places. The leaves are used for feeding silkworms in times of scarcity of mulberry leaves. This plant makes a similar impression to the Osage Orange, but is of much smaller dimensions. It can be utilized in the drier parts of the United States as a hedge plant around gardens, as a fence material on farms, and, in the milder, semi-arid sections, for bank-binding. It is very thorny and can therefore serve very well for hedge purposes." There are several other species with edible fruits.

Specimens sent out by the Arnold Arboretum have already fruited at Augusta, Georgia, where those who have seen the tree have formed a high opinion of its possibilities. R. C. Berckmans, of

TCHO SANG, THE EDIBLE "OSAGE ORANGE."

This fruit, resembling the Osage Orange of the United States in appearance and closely related to it, is sweet and edible. It grows rapidly even in poor soil and a dry season. It is already being tried in Georgia as a stock food, and has proved very hardy. If hybridized with the American Osage mock orange, it would probably have a still greater range and make a larger fruit and tree. (Photo natural size.)

the Fruitland Nurseries, writes: "The trees which we have are from seed planted about five years ago. In 1912 we had the first fruit. The trees were then from two and one-half to four inches in diameter, and 10 to 12 feet in height.

"R. O. Lombard, of this county, who is largely interested in hog growing, thought the tree had merit as hog food. Last season we gave him all the trees we had except three. The three which we have in our nursery were cut to the ground, and have made about 10 feet of growth this season. Mr. Lombard also cut his trees back, and tells me that they made about four feet of growth. They would have made more but from the fact that he is in a very sandy section and has had a drought more or less through the entire season. The trees we have here have withstood some severe weather during the past five winters without injury.

"From the above data we would consider this tree rather a rapid grower, and one that will stand very low temperatures—probably zero and maybe lower. It can be readily propagated from seed or roots. I have noticed in the nursery rows where the trees were dug last season that quite a number of small ones have come up from the roots, and some at least 20 feet from where the original tree stood. As to its real merit as stock food we have as yet no real data."

The correspondence of these facts with those furnished by the mock or Osage orange (*Toxylon pomiferum* Raf., *Maclura aurantiaca,* Nut.) is striking. This tree, which is native of the region between eastern Kansas and northern Texas, sometimes reaches a height of 30 to 50 feet, but is best known in hedge form. It is hardy as far north as Massachusetts; grows readily and rapidly either from seed or roots, is a voracious feeder and not particular about soil, bearing its green, woody and inedible fruits, four or five inches in diameter, profusely. Its hard wood is valuable for fence posts. By making hybridizations between these two allied genera, horticulturists over a large area will have a chance to get some exceedingly interesting results.

Although the cross has not actually been performed in the United States, so far as the record shows, it is entirely practicable, for it was made in France by the late Edouard André, editor of *La Revue Horticole,* and described by him in that journal, under the name of *Macludrania hybrida,* in 1905, page 362. He says:

"In January, 1896, I made the readers of the *Revue Horticole* acquainted with a new variety of *Maclura aurantiaca,* fortuitously

produced in the garden of Mme. Helie of Bléré (Indre et Loire), and which I named *Maclura aurantiaca inermis.* In this variety, the spines which arm the branches of this species had entirely disappeared. Moreover, the vigor of the plant is superior to that of the type. It is another beautiful tree added to our collection of ornamentals.

"I added that as the subject was female (it is well known that *M. aurantiaca* is dioecious), I had the idea of fecundating it by pollen from a male specimen of *Cudrania triloba* which I possess at Lacroix and which, each year, in June, is covered with staminiferous globules. It was M. Guy of Bléré who undertook this operation and succeeded in obtaining fertile fruits. The seeds were sown and I obtained half a dozen plants which grew vigorously.

"It is this new hybrid which I now present to our readers.

"As the two genera are distinct, although related, I have employed, to create the name of the bigeneric hybrid, the formula which consists in taking the beginning of the first name and the end of the second. We have thus *Macludrania,* with the qualificative *hybrida.*

"The young plants which were grown from these seeds, and which are today in their eighth year, are now beginning to be clearly characterized.

"Until last year, I let them grow freely in their bushy form, which is now being modified by the development of strong shoots which tend to gain predominance over the weaker ones. Pruned specimens have a well-marked trunk, as large as a broom-handle. They have rather the appearance of the *Cudrania,* with its low stature, than the arborescence of *Maclura aurantiaca.* They are uniformly spiny and present no spineless branches, like their mother—which, however, was only an accident in the species. The form and foliage of all the specimens I have are identical. None of them has yet flowered, so I cannot tell whether they are of different sexes.

"The description of *Macludrania hybrida* is as follows:

"A small tree reaching (today) a height of three or four meters, at first bushy, then forming an erect stem with yellow, fissured bark, that of the preceding year being gray-green with transversal grayish-green corrugations; the branches of this year's growth light green at the ends, assuming a violet tint, as well as the upper parts of the petioles. Spines hard, woody, short, straight, at right angles to the axils of the leaves, very sharp, those at the tops of

THE AMERICAN OSAGE ORANGE.

A common hedge plant, native from Kansas to Texas. Its fruit reaches a diameter of five inches, but is woody and, except in rare instances, not even eaten by live stock. As the tree is hardy, a hybrid of this native form with the edible Chinese Cudrania may give an edible fruit that can be grown over a wide range in the United States even under adverse conditions of soil and rainfall.

the branches dark brownish-red, almost black. Leaves glabrous, alternate, with milky sap, not polymorphous, slender petiole of a violet shade on top, short (two to three cm.); 15 cm. long and 10 wide, oval, longitudinally acuminate, with very smooth, varnished surface, numerous small veins, the primary ones acutangular, subopposed at the base, all slightly depressed below the surface at the ends, prominent, pale and puberulent towards the base, accompanied, at the swollen base of the petiole, by two very minute, scarious bracts. Flowers unknown.

"This hybrid differs from *Maclura aurantiaca* by its weaker growth, its adult branches smaller and dark brown, its spines, at right angles to the axils of the leaves like *Maclura* but more numerous, closer together, shorter, very sharp and woody, those at the top reddish brown, almost black in autumn. It is more like *Cudrania triloba* in the slenderness and dark color of its adult branches, and differs from it in its short spines, not decurvent, the stipules of its young leaves shorter, the limbs not subcordiform at the base and more longitudinally acuminate, the absence of three-lobed leaves in its young growth. We will see later if these differences are accentuated in the organs of reproduction and in the leaves of the flowering branches.

"But it is curious to notice that the product of these two genera is much nearer the father than the mother, and we have every reason to suppose that the characteristics of the *Cudrania* will retain their predominance in it.

"The polliniferous tree, the *C. triloba* in the park at Lacroix, today measures eight meters in height, with a head seven meters in diameter. Its trunk is two meters long and 65 cm. in circumference at a meter from the ground. It is certainly one of the most vigorous specimens which exist in France. It now is a tree of great elegance, its lustrous foliage is never attacked by insects, and its innumerable little globes, the male flowers, pale yellow, almost creamy, exhale a sweet perfume during the fortnight (from June 15 to July 1) when they spread their pollen abundantly before falling to the ground. The tree was introduced from China to the Museum (Paris) in 1862."

It is necessary to note that the specific name *triloba* which M. André used has been set aside by the earlier one of *tricuspidata*. Although the French experiment does not give conclusive evidence as to the range of these trees, it is encouraging enough to make wide experiments at once desirable in the United States.

TO BRAZIL FOR NEW PLANTS

Expedition Sent to Unexplored Country Promises to Obtain Many Things of Interest to American Plant Breeders—Problem of the Navel Orange of Bahia

The departure on the Steamer *Van Dyck,* October 4, of Messrs. P. H. Dorsett, A. D. Shamel, and Wilson Popenoe, for an exploring trip in Southern Brazil, inaugurated a new policy in the work of the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture. Heretofore the search for new plants has been made single-handed. Each explorer has been called upon to do practically all his own scientific work, except in so far as hired guides, interpreters and laborers, picked up in the countries through which he traveled, have aided him. The large amount of detail work involved merely in getting from place to place in a strange country, has necessarily limited the number of observations recorded, the number and character of photographs taken and the botanical material collected.

This expedition has gone out fully equipped to get not only the living seeds and plants which are necessary, with which to begin experiments in this country, but as complete herbarium material as possible which will enable all new plants discovered to be scientifically identified and, what is nowadays quite as important, to make natural-size photographs illustrating the important characters of the plants and all phases of their culture by the Brazilians.

This expedition has been made possible through the hearty cooperation of the Office of Horticultural Investigations, in allowing Mr. Shamel, its physiologist, to form one member of it, and in providing part of the funds of the expedition.

The researches of Mr. Shamel in California have revealed the remarkable fact that the Bahia navel orange, the first trees of which were introduced from Bahia in 1870 by Dr. William Saunders, of the Department of Agriculture, is now represented by at least nine bud-variation strains. These types or strains have been propagated by nurserymen, without being recognized by them, for the last 40 years. Some of them are valuable strains and others

quite worthless, and the citrus growers of California are now top-working thousands of trees of the worthless strains with grafting wood of the superior ones.

The rumors brought by nearly every traveler up the coast of Brazil to the effect that the Bahia navel oranges in Bahia itself are superior to our California navels and the fact, ascertaind by correspondence, that the Brazilians recognize two distinct types of stocks for this variety, make it seem of great importance to have made by the man who is most competent to do it, a thorough study of the navel-orange situation in Brazil. Did we get in 1870 the best strain of Bahia navel orange and are we now using the best stock for it, are questions whose elucidation will form one of the principal objects of the expedition.

The Maté industry of Brazil has reached such proportion that it is worthy of careful investigation, inasmuch as it can be produced for a fraction of the cost of tea and will supply the same alkaloid in a more easily soluble form. Promising forage grasses, a whole range of new sub-tropical fruits, several new fibre plants, rubber-producing species and bamboos are some of the many possible introductions from Southern Brazil.

The region is comparatively little known, however, and it is expected that many plants of interest to American cultivators, but not recorded in the literature, will be discovered. As the uplands of Southern Brazil are visited by frosts, and as there are dry desert regions surrounded by dense forest areas, the chances for finding plants adapted to the South seem particularly good.

The expedition will confine its work this season to the provinces of Bahia, Rio, Minas and Sao Paulo, and it is expected that a preliminary survey of the situation there can be made in about six months' time, although it is anticipated that at least one member of the association will remain longer in the field.

The office of Foreign Seed and Plant Introduction will be glad to learn from plant breeders of any material known to them, which should be secured by the expedition during its stay in Brazil.

David Fairchild.

BREEDERS' ASSOCIATION WILL CHANGE ITS NAME

As soon as certain necessary legal formalities can be fulfilled, the American Breeders' Association will become the American Genetic Association. The AMERICAN BREEDERS' MAGAZINE will, with the present number, end its fourth volume, and begin next month in a larger size under the name of THE JOURNAL OF HEREDITY. Its character and scope will, of course, remain the same as at present, except as improved by a steady effort to raise the standards as rapidly as the resources of the association allow.

While the name of the association and magazine were correct at the time of their foundation, it has been felt by a large section of the membership for several years past that the word "Breeders" no longer accurately described to the general public the purpose of the association, since in the public mind it was connected solely with live stock. The steady growth of eugenics, and the full recognition granted to this new and important science by the association, have further made a change of name desirable. At a meeting of the council held in the University Club, Washington, D. C., on November 15, it was voted to make the change without delay, as above outlined.

The council considered with much deliberation the present status of eugenics in the United States. There is a general recognition among members of this association that the need is urgent at the present time for active and scientific leadership of the rapidly growing eugenics movement, lest it be detached from its proper base of genetics and be captured by sentimentalists and propagandists with slight knowledge of its biological foundation. The council accordingly arranged for the creation of Committees on Education and Extension, whose function it will be to endeavor to guide public sentiment along strictly scientific lines, in a more active way than is possible to our present Committees on Research. The personnel of the new committee or committees will probably be announced in the next issue of the magazine.

Arrangements were completed for the publication of the magazine (under the name of THE JOURNAL OF HEREDITY) regularly each month from now on. Its size will be seven by ten inches.

For many reasons the council decided not to hold any single general meeting of the association in 1914, but to hold, instead, meetings of the three research committees, at the call of the chairmen of the respective committees after consultation with their associates. These meetings will bring together the men actively engaged in each line of work, and will, it is hoped, offer the opportunity for the achievement of some serious scientific results. The magazine will be the vehicle for coördination of the three sections.

It was voted to hold a general meeting in 1915, in connection with the Panama-Pacific International Exposition at San Francisco. Dr. H. J. Webber and Dr. E. B. Babcock, both of the University of California, were named as a local committee in charge of arrangements. The exact date will be decided later.

In order to give at least a slight compensation to members who publish results of their work in the magazine, the council voted to give to each contributor twenty-five copies of the issue in which his article appears, with the privilege of buying as many more copies as he wishes of that issue at ten cents each, provided an order is placed in advance of publication. In the case of articles of a more technical character, fifty separates will be furnished, instead of the bound magazines, if the author requests it when submitting his contribution. The editor was instructed to insist on full and satisfactory photographic illustration of every article capable of such treatment; unillustrated contributions will be published only in exceptional cases.

The general question of formation of branch associations, and affiliation of local breeding and eugenic societies with this association, was considered and arrangements made whereby such affiliation can be put into effect on terms equitable to both parties.

The Secretary reported a surprisingly keen interest in the association, considering that its activity was entirely suspended throughout the summer. New members are voluntarily coming in daily, attracted principally by the coöperative feature of our work. At present the only hindrance to the fullest possible efficiency of the organization is the carelessness of many members in neglecting to pay their dues promptly.

Photograph by David Fairchild, copyright, 1913, by the A. B. A.

REPRODUCTIVE ORGANS OF HIBISCUS.

At the top is the female organ, the stigma, supported on its slender column called the style. Around this style, completely enclosing it, are the many stamens, grown together into a solid tube, over the surface of which are scattered the pollen-containers or anthers. The pollen grains are seen falling from these anthers. (Fig. 1.)

REPRODUCTION IN HIBISCUS

David Fairchild

Every practical breeder of plants is familiar with the appearance of pollen, and knows how it looks when the anthers, or male organs, of the flower split open, exposing the golden yellow pollen grains so that the bees can get them. To the general public, however, who do not carry pocket microscopes, this photograph will perhaps be instructive. It is possibly the first one ever made to show the pollen tumbling from the anthers.

The dark, furry or hairy top of the figure, which looks like a felt hat, is the stigma of the flower, its female reproductive organ, which is supported on a slender column called the style. Around this style, completely enclosing it, are the many stamens, which in this species have grown together into a solid tube, over the surface of which are scattered the kidney-shaped pollen containers or anthers. In the photograph, these anthers have opened lengthwise and the pollen grains are tumbling out. They are golden yellow, and stick together when fresh, but as soon as dry they come off on one's hand with the slightest touch. These pollen grains are covered with minute spines, too small for the camera to bring out.

When one of these grains is carried on to the surface of the stigma by some insect, it sends out a long, slender tube, which grows down through the soft tissue of the pistil, until its tip encounters the embryo sack which is enclosed in the swollen base, or ovary, of the pistil. In this ovary lies the egg cell with its unfertilized nucleus. The moment that pollen tube and embryo sack touch, there forms an opening between the two, and a nucleus slips from the pollen tube tip into the egg cell. This male nucleus gravitates instantly toward the female nucleus, and the two join and together start the activity which divides the first cell and sets in motion the whole marvelous machinery of cell growth, which leads to the seed and, subsequently, to the tree or shrub or whatever the plant may be.

The procedure in practically all flowering plants is essentially similar, and in animals this essential part of the process—that is, this fusion of nuclei—is practically universal.

It is this great borderland of knowledge which attracts the real plant and animal breeder, for he feels convinced that any knowledge of these beginnings of individual life must give tremendous power to the coming generations of human beings.

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RESEARCH IN EUGENICS

CHARLES B. DAVENPORT

Eugenics is a subject that can be considered from many points of view; but the engenical interests of this Association have always been connected with research in that field. The inquiry is a fair one;—how can research be made in eugenics?

If, in seeking an answer to this question, we turn to plant and animal breeding, we find in these fields methods which have for some time been standardized and are highly successful in yielding results. If it is desired to improve a race, one determines by appropriate matings the method of inheritance of the traits which it is desired to combine in the improved breed, and then one makes such matings and those of second and third or even later generations of the hybrids as shall yield a more or less nearly pure strain—*i. e.*, a strain reproducing in successive generations the desired combination of qualities.

The application of these methods to man has its clear limitations. It is not in accordance with the social ideals of our time that people should be mated as roses and lilies, or canaries and butterflies, are in order to determine how particular traits are inherited. The produce of the mating is so vastly important, the launching upon the cosmos of an immortal soul (we are told) so momentous a thing (not to speak of the birth of a new potential voter and national ruler) that society can not permit of experiments in mating people just to satisfy the curiosity of the man of science. Fortunately, the man of science has no need, for his purposes, of controlling the matings of men. Matings as they are made, with little effective interference or regulation by organized society, afford him all possible combinations; more perhaps than the most ingenious student of genetics could have planned. It remains for the student of eugenics merely to observe the produce of the various matings that have been made. By the study of the characters of the offspring in relation to the characters of the parents, grandparents, uncles, aunts and first cousins, the laws of inheritance of characters can in many cases be worked out. What the student of human heredity needs is accurate, full data concerning the distribution of characters

in a fraternity, in the individuals that stand near of kin on the father's side of the house and in the individuals that stand near of kin on the mother's side of the house.

The methods of getting this data are various. The most satisfactory way, in many respects, is to secure the coöperation of numerous intelligent, sympathetic individuals in recording their family traits through three generations as just specified. If, then, these records are sent to a central bureau for analysis, we may expect the method of inheritance of many characters soon to become known. Incidentally, an intelligent person will find this work of recording his own traits and that of his relatives a matter of great interest to him while he is doing it. Moreover, he may well consider it a duty both to the nation and the rising generation in his own family to secure such data from those who alone can supply it, while they are still alive, and to record it.

To facilitate the task of making this record the Eugenics Record Office has had prepared blank schedules—called "Record of Family Traits"—of which it is ready to mail a copy, without charge, to any person who will write for it and agree eventually to deposit a copy, filled out, with that Office. In the Office are now deposited over one thousand such records, which have been submitted to it in confidence, and which are being used for analytical purposes. When desired, two copies of the schedule are sent, in order that one may be retained by the compiler and preserved among the most treasured family possessions.

If you would like to take a share in this work of eugenic research, write to the Eugenics Record Office, Cold Spring Harbor, Long Island, New York, for one (or two) copies of the "Record of Family Traits."

Constructive Eugenics

It is possible that if some of the philanthropic endeavor now directed toward alleviating the condition of the unfit should be directed to enlarging the opportunity of the fit, greater good would result in the end. In breeding animals and plants the most notable advances have been made by isolating and developing the best, rather than by attempting to raise the standard of mediocrity through the elimination of the worst.—H. E. Walter: "Genetics."

STRANGE SHEEP OF ASIATIC RUSSIA

Broad-Tailed and Fat-Rumped Creatures Among Hardiest Domestic Animals Peculiar Results of Hybridization—First National Sheep Congress at Moscow

Dr. C. C. Young, *Belen, Texas*

The sheep of Asiatic Russia, mostly brown or black in color, and hence easily distinguished from the sheep of European Russia—which are always white unless they have become pigmented by the black Danadar or red Kúrdiuk—are noted for their great hardiness and wonderful disgestive abilities. Whether of the fat-rumped (Kurdiuk) type, (*Ovis steatopyga*) or the broad-tailed species (*Ovis platyura*), they are perhaps the hardiest domestic animals known, with the exception of the camel and burro. The introduction of these sheep into the United States for the purpose of fur raising, and to improve the hardiness and mutton of some of our odoriferous shortwools of the Southwest is a task we have assigned to ourselves, and the pursuit of this task found us in Moscow, Russia, at the time of the first national sheep congress there, from the fifth to the fifteenth of October, 1912.

The success of this convention, the outcome of many years' work, is largely due to the intelligence and industry of Count Stcherbatiev, president of the Agricultural Society of the Province of Moscow. He was vigorously assisted by His Excellency A. S. Yermoloff, for twelve years minister of agriculture, and now a senator for life, and member of His Majesty's Council. It is to this gentleman that much credit is due for the success of the importations of Karakúl sheep into the United States in the past. He was chairman of the convention; the vice-chairman was Pavel Petrovich Ganko, one of the most competent authorities on the Karakúl breed. Mr. Pravochinsky, chief of sheep investigations in the department of agriculture, was secretary. Among the judges was Dr. J. V. Sinitzin, the greatest Russian authority on Karakúl; some fourteen years ago he imported the first herd of these sheep to Crimea, and

TWO-YEAR OLD CHULMI.

This ram belongs to a class from Bokhara in Turkestan, a region with a very severe desert climate. By natural selection the sheep of this region have become among the hardiest demesticated animals. (Fig. 2.)

for his excellent book, "Malitch and Arabi," received the degree of Magister of Veterinary Sciences. The exhibition was held at the Moscow Agricultural College, situated at the beginning of the beautiful Smolensky boulevard.

According to Palace and Natusius, the sheep of Europe and Asia are divided into four classes,—namely, longtails, shorttails, fat rumps and broadtails. We are not satisfied with this classification, especially when it comes to the longtails, to which most of the English breeds belong, as do the Merinos, the common Russian longtail, Tcherkes and Sigei; and we do not consider that such grade fur-producing Karakúls as the Sokolievskaja, Reshetilev and Tshushka, belong exactly to this class,—we are inclined to classify them with the broadtails. However, all of these classes were repre-

FAT-RUMP RAM FROM CENTRAL ASIA.

The development of the two huge but symmetrical globules of fat which have covered the buttocks is well shown in this photograph of a black ram of the class Tshuiskœ. The tail is practically atrophied. (Fig. 3.)

sented at the fair. The Northern and Romanovskaja are shorttails indeed worth mentioning. Among the fat rumps, which *per se* are not fur producing, there were a great many breeds, such as the Kalmik, Kirghiz, Mongol, Burat, and numerous "Kurdiuks," from the Caucasus and Bokhara. We were surely convinced that these long-eared sheep, usually red, and bearing tremendous, symmetrical, fat pillows, that hide the short, often atrophied tail, have not the same origin as the Karakúl breeds. We are reminded at this moment of a statement made by Charles Goodnight, of Texas, some three years ago, when he rightly insisted that his red mutton Persian fat-tails from which Col. Jones, of Las Vegas, got his start should not be called by us broadtails.

BROADTAIL VOLOSHSKAJA RAM.

Although only six months old, his tail is dragging on the ground. At maturity, it may weigh as much as forty pounds, and may have to be supported artifically, in order to enable its owner to walk. (Fig. 4.)

The exhibition of a number of breeds coming from the Caucasus (Asia Minor), and resulting from crosses between fat-tails and broadtails, was very interesting indeed. Those most noteworthy were the Erik, Bozach, Mazech, Karabach, Lezgink, Osetin, Avar, Tushin, and Kjara. We were told by a Tartar gentleman, A. Ayrap Kalantar, of Tiflis, that these sheep had the very best of mutton and that they could endure any amount of hardship.

The broadtail class was very well represented. There were Karakúls, Malitches, Pirnajas, Valoshskaja, Karachaev and Tushinskaja. Of these we purchased several, as will be explained later. The Karachaev is said to be even better than the Karakúl when it comes to mutton. We had an occasion to eat Kirghiz and Kalmik "butter," *i. e.*, the fat obtained from the "fat-tailed" sheep,—a name that

should not be used, as the tail of this class of sheep is generally atrophied by the great pressure of the two symmetrical, fat lobules, weighing often thirty pounds; and if present at all, is only about three inches long and not thicker than a finger.

Of the many breeds present the Karakúl, Voloshskaja, Kalmik, Reshetilev, Sokoliev and the Bessarabian Tshushka received the most attention. It was conceded that all of these sheep, except possibly the Kalmik, when crossed with Karakúls, would greatly gain in weight, besides giving excellent skins, which could be utilized for fur purposes. It was especially pointed out that inbreeding must be discontinued and proper selection practiced when it comes to rams intended for breeding. It was unanimously agreed that sheep raising in European Russia could only be advised on a small scale, because the land, being mostly all under cultivation, commands high prices. In the Caucasus, where the large, open steppes made it possible to raise millions of merinos, conditions are rapidly changing. The land is being put into wheat and other small grain. The only Russian steppes that still offer inducements in sheep raising on a large scale are found in Central Asia and Turkestan, where certain nomadic people, as, for instance, the Kalmiks, Kirghiz, Turkmans, Nogaitzi, Sarts, Uzbecks, Tadjveks and other uncivilized Asiatic tribes, are still keeping large flocks; but all of them belong to the coarse-wool varieties, except the pure Afghan fine-wool. The fine-wools, such as the Merinos (having no fur qualities, and in crosses, in fact, ruining the best fur-bearing Karakúl breeds), never did get a start, as it was found that they were not hardy enough to exist in those countries, where a sheep must possess greater "rustling" qualities and be able to go for days without water.

But as every year the Russian Government opens for settlement large tracts of the best of those steppes, some of which are irrigated and others open to dry farming, it is but a matter of a few years when the sheepmen will have to go out of business.

On account of the great increase of late years in the price of grade Karakúl lamb skins, known under the trade-name of Persians and Astrakans, it was decided to ask the government to find ways which would enable the breeders to bring these sheep into European Russia in larger numbers and at less expense. It was pointed out that the peasant would receive almost double the crop from land

KHIRGIZ RAM FROM CENTRAL ASIA.

Sheep of this fat-rump type are usually red, with long pendulous ears and coarse wool. As the lobes of the rump are pure fat, it is cut off and eaten by the natives under the name of "Khirgiz Butter." (Fig. 5.)

on which from time to time sheep have been pastured, and could thereby eliminate the great expense of fertilization. To insure the best breeding rams, the organization recommended the establishing of special breeding stations all over Russia with a view to supplying the peasants with the best and cheapest of rams, the expenses to be borne entirely by the government. Those peasants too poor to buy rams are to have a chance to breed their ewes to these rams free of charge.

When we made our first importation of Karakúl sheep (a term synonymous in Turkestan with the Arabi), we assumed that this breed, when crossed to our longwools, would give us not only fur, greater hardiness and better mutton, but also a much greater weight, and that is the case where the red fat-rump Kurdiuk predominates

in the Karakúl, as is the case with the pronounced type of Dúzbai Karakúls. In one case a Valoshskaja sheep, originating from a cross of fatrump on longtail, weighed nearly twenty pounds more than the heaviest red fatrump at the exhibition. These hybrids show at a glance that they are heavier than our Lincolns, which are the heaviest sheep in America and England. It is indeed strange that the result of the cross above mentioned should have excelled in weight the largest Kalmik fatrump on exhibition; and we bought this specimen, which was owned by Tiu-Men, a Burat chief. The Russians named this Kalmik ram "Verbliud," which means camel, and indeed that name is quite appropriate, judging from his size.

About the difference between "fat-rump" and "broad-tail" sheep, we beg to refer those interested to our article in the September, 1912, issue of THE AMERICAN BREEDERS' MAGAZINE, in which we freely acknowledged our mistake as regards the weight of the Karakúl, stating at the same time that the fat-rump, such as the Kalmik, is the heaviest of all known sheep. That statement is true, if we permit ourselves to forget the statement made above in regard to the Volòshskaja hybrid broadtail. I asked the naturalist Sinitzin if he could assure me that there was not fat-rump blood in this hybrid, and his answer was emphatic that there was not, as he had never found any traces of brown pigment, which is the pigment of the purest types of the fatrumps. But we believe that Sinitzin is mistaken, nevertheless.

The typical fatrump is the largest sheep known, red in color, coarse stiff wool, like our mountain sheep, with the huffs of the extremities so built as to enable it to remove snow and find feed, and, what is most important, the tail consists of only three or four vertebrae, generally atrophied, with two *immense* symmetrical fat lobules covering the buttocks and extending below the knees, weighing from twenty to forty pounds; long pendulous ears, decidedly convex nose and a very large head.

Among our purchases at the fair was, as already stated, a brown, fat-tailed Kalmik buck, but we took him mostly for educational purposes, although the great size of the animal with the immense fat lobules will no doubt appeal to our breeders. Unfortunately, our breeders do not know the difference between a fat-rumped and a broad-tailed sheep (it is not so very long since we found it out ourselves) and often contaminate the red, long-eared Persian fat-

ACHURI EWE FROM BOKHARA.

This black two-year-old is of a type evolved by nature in Central Asia, where such fine wool breeds as the Merino have never even made a start, because they are not hardy enough. Black pigment due to Danadar admixture. (Fig. 6.)

rumps with the gray, broadtail Arabi, and every once in a while I am asked to help market the worthless lamb skins of "Persian" fat-rumps, of which we owned several hundreds, such breeders believing them to be the valuable Persian lamb skins only produced by the Karakúl breeds.

We also bought a four-horned Karachaev from a Turkman chief of Middle Asia, which was represented to us to be a fertile hybrid, resulting from a cross between a grade Arabi and a native wild goat (?). There were several such specimens on exhibit, and we were impressed with the luster of the lamb skins, even though the curls were absolutely open, more so than is the case in the Astrakan type. It is, however, a very wild, dangerous animal, requiring several men to handle it, but it possesses most delicious mutton. In

AN IMITATION OF THE KARAKUL.

Five-year-old ram of the Bessarabian class of Tshushka. Note its close resemblance to the famous Karakúl. It produces a very good fur, and would probably gain largely in weight if crossed with the Karakúl Dúzbai. (Fig. 7.)

its movements it reminds one of the wild white Alaska goat. It is our opinion that the Karachaev is what is left of the black Danadar which found their ways out of central Asia to Asia Minor.

In another article we shall describe our trip through central Asia to get authentic specimens of the Karakúl breed; we shall explain the fatal mistakes of our first importation in 1908, and shall give the data we collected, on which we base our opinion as to the real origin of all the Karakúl breeds.

Need of Education

The eugenic conscience is in need of development, and it is only when this becomes thoroughly aroused in the rank and file of society as well as among the leaders, that a permanent and increasing betterment of mankind can be expected.—H. E. Walter: "Genetics."

BREEDING MEDICINAL PLANTS

Growers Select Most Powerful Drug-Producing Strains and Seek Correlation Between High Potency and External Characteristics

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Products of medicinal plants are, in their way, as valuable to mankind as those from the cereal, vegetable, fruit, flower, fiber and other economic plants under cultivation. The latter have all yielded to the principles of plant breeding, and have supplied man with a wealth and variety of products which nature's laboratory has never equalled. Why should not medicinal plants yield and produce in a similar manner, and through cultivation and improvement be made to furnish mankind with more efficient remedies against disease?

An examination of the crude vegetable drugs as they occur on the markets of today reveals a mass of inferior materials far in excess of what might be expected. Much of this material is unfit for manufacturing purposes, through adulteration with unknown and worthless admixtures, partial or complete substitution of one plant or plant part for another, or because it is made up of old, inert, mouldy drugs which may have been stored under adverse conditions or collected out of season and improperly cured and packed. All this is due to a lack of power to control the production of crude vegetable drugs. Too much must be left to nature or to none too well informed collectors. The faults and inefficiencies of nature need little comment. A comparison of a few improved varieties with their wild ancestors is sufficient evidence that nature is poorly equipped for the production of improved strains.

Ignorant collectors many times are a menace. Personal experience with many of them has revealed an absence of any sense of responsibility, and but little power of discrimination in selecting and identifying plants. They cannot separate closely related species, a procedure often necessary in the intelligent collection of medicinal plants, and frankly refuse to observe certain rules governing collec-

tion and curing. It is thus evident that the variations of nature, associated with ignorance, often give to the pharmacist and practicing physician a poor or suspected product. Rigid inspections must be enforced at all stages in the process of manufacturing medicinal preparations. But however rigid these inspections may be, they cannot overcome all the variations of plant growth or correct all the mistakes of careless collectors. The supply of medicinal plant products should be controlled with the same degree of nicety as that of agricultural products, or even with greater precision, since in many instances a life is dependent upon the strength and purity of some vegetable drug.

Plant breeders are supplying fruits of varying acid values, corn of high and low percentage of oil and protein, carefully selected sugar beets of high yielding power, and varieties of tobacco suitable for various purposes according to an indicated nicotine content. All of these achievements and numerous others are noteworthy. Of a different character, but of no less importance, are the drug-producing plants which yield the alkaloids, glucosides, saponins, resins, oleoresins, etc., upon which their curative property depends. Cannot the plants yielding these so-called active principles be brought under the influence and control of the breeder, and be made to produce their respective products more abundantly and more consistently than in the wild state? In attempting to answer this question, experiments have been started with several medicinal plants which will extend over a considerable period of time, and involve various problems of selection and breeding.

The Solanaceae offer as rich a field in the development of improved medicinal forms as they have already offered in the production of the potato, tomato, egg plant and capsicum among food-producing plants, and the datura, solanum, capsicum and tobacco in decorative forms. In the terminology of the druggist there is found within this family the very important forms belladonna, henbane and stramonium, all yielding alkaloids and readily amenable to chemical methods of assay. These three genera, in addition to others from different plant families, are being used in the above-mentioned experiments. Chemical and biological methods are being used in checking and following the progress of the work. It is hoped that correlations may be found to exist between high potency and certain morphological characters. This would eliminate, in part at least,

the chemical and physiological assays, which are expensive, and somewhat long. Following is a brief discussion of what is being done with some of the forms under investigation.

Both the leaves and roots of belladonna (*Atropa belladonna*) are used. They must yield, respectively, 0.30 per cent. and 0.45 per cent. of alkaloids. During the past three years, six per cent. of all shipments of the leaf examined were below standard. The variation in percentage of alkaloids for the same period of time was from 0.23 to 0.62 per cent., average 0.43 per cent. Of the shipments of root examined, 28 per cent. were below standard, with a variation of from 0.17 to 0.66 per cent., average 0.48 per cent. No attempts have been made to breed belladonna for a high yield of alkaloids, a possibility which is suggested by the range of variations as indicated above. That the belladonna plant does possess a higher yielding power than average figures would suggest, is shown by a yield of 0.9 per cent. of alkaloids which was obtained upon a plot fertilized with commercial acid phosphate. Such a high yielding power as this would of course not be transmitted by these plants to their offspring. It is only mentioned to indicate the possibilities of locating high yielding plants by testing leaves from selected individuals.

A number of such selections have been made. Individual plants were selected, numbered and inbred. Samples of leaves were taken from these individuals upon which to determine the alkaloidal yield. These selected plants were also propagated vegetatively, and the resulting plants are being grown in the greenhouse. Some of them are growing in pots in the original soil in which the parent plants were grown, while others are growing in various mixtures of widely differing soils. In this manner it is hoped that some information may be gained upon the behavior of the alkaloids with respect to inheritance, effects of soils, variation in yield from plants grown from open pollinated and close fertilized seeds, and from those propagated by cuttings. The selected plants so far tested indicate a variation in yield of from 0.55 per cent. to 0.87 per cent. of alkaloids. The progeny of these plants of known yield will be tested in a similar manner.

The external characters of the belladonna plant are extremely uniform, with the exception of total yield of leaves and roots per plant. This exception will be taken advantage of in selecting for

SELECTED FORM OF INDIAN HEMP.

Drug-producing plants show a wide range of variation, and this photograph shows one extreme of the forms of *Cannabis sativa* or Indian Hemp which, aside from producing seed for canaries, furnishes a powerful narcotic drug, used like opium in nearly all parts of the orient, but particularly among Arab peoples and in India. (Fig. 8.)

ANOTHER FORM OF INDIAN HEMP.

This photograph shows the other extreme of the forms in which *Cannabis sativa* is found. Not only is the type of plant different but the character of inflorescence is changed. It is believed that these changes in form may be used as clues to detect changes in the chemical properties of the various drug-producting plants. (Fig. 9.)

increased production of these products. Individuals vary in amount of dry root produced from 139 grams to 203 grams. It has been stated that the percentage of alkaloids in the roots of this plant increases markedly after the first year and reaches a maximum at the end of the third year's growth. Belladonna is not perfectly hardy throughout the central United States, and more hardy strains must be developed before the above condition can be observed to advantage. Sixteen hundred plants are now being tested in the vicinity of Indianapolis for relative hardiness.

Henbane is a pharmacopeial drug, supposed to consist of the dried leaves and flowering tops of *Hyoscyamus niger* collected from plants of the second year's growth. This product must yield not less than 0.08 per cent. of alkaloids. Records covering one hundred and two inspections of this drug, purchased in the drug markets of the United States, show but thirteen per cent. with a yield of alkaloids equal to or above this requirement. The remaining eighty-seven per cent. vary from 0.018 per cent. to 0.075 per cent. From a botanical point of view, this drug is also far from uniform. Many samples and shipments contain seeds which germinate readily and, when grown to maturity, furnish a means of accurately identifying the original material. A number of shipments have been checked in this manner during the past two years, and annual plants have been found in nearly all cases. The official requirements state definitely that the drug must be collected from plants of the second year's growth. However, without some provision for controlling this collection, little can be done toward obtaining an official product in this respect. Certainly the above conditions of alkaloidal yield and botanical origin of this drug are strongly suggestive of the necessity and desirability of subjecting the genus to a thorough and rigid investigation. This investigation should have to do with the isolation and cultivation of the annual and biennial forms, as well as all species and varieties of these. Individual plants should be selected for breeding purposes, and tested for yielding properties in the same manner as described for belladonna.

Stramonium has been taken up in a similar manner, and the work on *Datura stramonium* and *Datura tatula,* two common forms, has now been carried through the second year. Selections of *D. tatula* gave a variation of alkaloidal percentage of from 0.47 to 0.65. The plants yielding these extremes produced offspring as follows:

Of ten individuals from the plant yielding 0.47 per cent. alkaloids, a range of from 0.44 per cent. to 0.57 per cent. was obtained, the average for the ten being 0.51 per cent. Of the same number of individuals from the plant yielding 0.65 per cent., a range of from 0.43 per cent. to 0.77 per cent. was obtained, the average in this case being 0.65 per cent. In the first group seven of the ten plants tested exceeded the parent in alkaloidal yield, while in the second, only five exceeded the parent. It is of interest to note that the lowest limit (0.43 per cent) was found in the progeny of the high-yielding plant (0.65 per cent), the lowest limit in that of the low-yielding plant (0.47 per cent.) being 0.44 per cent. The most promising feature of this experiment in its present stage is the greater average yield obtained over that from wild plants from the same locality. A mixed sample of leaves from uncultivated plants of *Datura tatula* gave a yield of only 0.35 per cent. in comparison with average yields of 0.51 and 0.65 per cent. from selected plants. These latter figures might also be compared with the average yield of commercial shipments of stramonium as noted for three years, which is 0.34 per cent. The analysis of the *Datura stramonium* selections of the past year, which were performed in the same manner as those of *D. tatula*, have not been completed. The parent plants, however, from which these selections were made, gave yields of 0.46 per cent. and 0.55 per cent. respectively, which figures represent the low and high limits obtained from a number of individuals.

Two other varieties of stramonium not common to this country were grown and tested. These were *Datura humulis flava*, bearing large, beautiful, double yellow flowers of peculiar fragrance, and *Datura ferox*, a form very closely resembling *D. tatula*, but having a more vigorous and robust habit. Both of these forms were obtained from Germany. The first contained, in a mixed sample, 0.42 per cent. of alkaloids, and individual selections of the second gave a variation of from 0.53 per cent. to 0.70 per cent of alkaloids.

It is to be regretted that none of the first plants selected for testing were close fertilized. During the past year, all selected plants were inbred, and only these will be used in continuing the work. Twenty crosses were made among the three species, *stramonium*, *tatula* and *ferox*. The effects of these crosses upon alkaloidal yield, as well as upon visible characters, will be noted during the next growing season.

Digitalis, the common garden foxglove, has been chosen as another medicinal plant upon which to test the effects of breeding. It is also an official drug, and must consist of leaves from the second-year plant of *Digitalis purpurea* at the commencement of flowering. This form has been included for experimental purposes on account of its value to the physician and because of a wide variation and much uncertainty in physiological effect. There is also a lack of experimental data upon such questions as the comparative value of the wild and cultivated plant and of the many different species and varieties, of the effects of cultivation upon medicinal value, time of collection, methods of curing, packing and storing and of the influence of various ecological factors.

In the study of the group, it is not only desirable to compare the many species and varieties medicinally, but also to determine their relative yield of crude material, ease of culture, hardiness, flowering period and the effects of hybridization upon these respective characters.

Thirty-two forms, consisting of both species and varieties, are under observation. These have been started from seed purchased of commercial seedsmen. The most prominent trade catalogues from this country, England, Germany, and Japan have been examined, and all forms of the foxglove listed in them have been obtained. Some of these were started in the greenhouse as early as December, in an effort to bring as many of them as possible into flower the first year.

The early flowering individuals are being utilized for breeding purposes, in the hope of obtaining either annuals or biennials of a higher and more uniform quality. Mixed samples of leaves collected from plants of the first year's growth of all varieties studied have been biologically tested. Many of the varieties test as high as a good commercial drug, and some of them even exceed this article in relative strength, as indicated by the above method. Others have proven extremely inactive, the poorest, as indicated by the physiological tests, being only one-sixth as active as the best.

In addition to biological tests, the external characters must also be closely observed. Upon a basis of leaf forms, the genus is easily divided into two groups. One of these is characterized by broad, rough leaves and includes such varieties as *purpurea, monstrosa, alba, gloxinioides* and others. They vary greatly in physical char-

acters, and apparently hybridize with considerable ease. The other group is characterized by narrow, smooth leaves and includes such forms as *lanata, ambigua, grandiflora, sibirica, canariensis* and others. The members of this group vary little in external characters, and hybridize with considerable difficulty.

The foregoing is only expected to serve as a suggestion to those who may be interested in, or have the opportunity to observe or investigate, medicinal plants. Much good will have resulted if better crude drugs of vegetable origin can be produced from the wild forms, by an application of the rapidly advancing views of the practical breeder. It is only just that the demands upon the plant kingdom should be exhausting, and such will not be the case until medicinal plants are included in the category of the plant breeder.

Research and Practice

There can not, I think, be any doubt that both the practical breeder and the student of heredity would profit much by a knowledge of the methods employed and the results obtained by the other. It is a question which of the two would gain most: the man of science by the knowledge of the facts relating both to the successes and failures of the breeder; or the breeder by an acquaintance with the principles elucidated and the precision of the records kept and the methods employed by the man of science. It is desirable that the student of heredity should, for the sake of his science, become interested in breeding. It is desirable that the breeder should, for the sake of his art, become interested in heredity. And, in general, it is desirable that each should recognize that he has much to learn from the other; for though, as we have seen, the objects of their work are different, the problem which they are both investigating is the same.—A. D. Darbishire: Breeding and the Mendelian Discovery (1911).

A Eugenic Conscience

A far more effective means of restricting bad germplasm than placing elaborate marriage laws upon our statute-books is to educate public sentiment and to foster a public eugenic conscience, in the absence of which the safeguards of the law must forever be largely without avail.—H. E. Walter: "Genetics."

COLOR IN SHORTHORN CATTLE

Sources of Error in Computation from Matings Very Large—Roan Perhaps a Simple Dominant Pattern Depending on Arrangement of Red and White Hairs

EDWARD N. WENTWORTH, *Ames, Iowa*

The colors of Shorthorn cattle have been a familiar subject of investigation for many years. The breed differs from most cattle breeds in having a diversity of colors rather than a single one, reds, whites, red-and-whites, and roans being the somatic classes. Bateson, Wilson and others have made the suggestion that roan is the heterozygous condition of red and white in crosses and have postulated a simple mono-hybrid ratio to cover the results. Wilson has supported this by the presentation of data under several titles, but the fact that such a hypothesis is only approximate was pointed out by Barrington and Pearson in a rather extended study.

Laughlin in 1910-1911 built up a hypothesis that accounted for the objections made by the biometricians, but to many it has seemed that the explanation, while suggestive, is somewhat more involved than the facts demand. Laughlin's study was largely based on pedigree records, a source that normally contains five per cent. of error and for a period of a few years in Shorthorns (due to fashion), shows as high as thirty-five per cent. The writer made an error in supplying data to Mr. Laughlin, which was not discovered until December, 1912, but for which an apology is certainly merited. On page 709 of his paper, in the course of a tabulation it appears that 136 roans were produced from "red by red and white matings." This should have read "red by white," the words "red and" being redundant. Also there should have appeared in the tabulation 145 roans from white roan matings. These errors resulted from trusting a student in whom confidence ought to have been justified, but unfortunately the horse was stolen nearly two years before the stable was locked.

A discussion of the sources of error in the Shorthorn records is of importance. The commonest method is in the recording of reds, red-and-whites, and very dark roans or spotted dark roans. For a period of over one hundred years, red was the fashionable color of the breed. This lasted until the eighties in the open market, when the growing popularity of Scotch roans served to set it aside, but the red "craze" still persists with hundreds of small breeders. In proportion as reds were popular then and roans now, one finds that whites and red-and-whites were in disfavor.

This had two effects. It caused the recording of many red-and-whites or dark roans as reds, in order to facilitate their sale, as is witnessed by the illustration in this article of the red and white bull, Diamond Goods 333014, who was the champion Shorthorn bull at the 1912 Iowa State Fair and the first prize aged bull at the International Live Stock Show at Chicago the same season. He is recorded as a red in the fair catalogs and the herd book, yet, as the illustration shows, he is obviously red-and-white. This lack of color popularity appeared also in the whites and prevented the registering of a large number, since there was little demand for them. In fact, it was a common belief of breeders that the only value in a white bull lay in his ability to neutralize red-and-white cows in the herd by siring roan calves from them. It is readily seen that the percentage of reds is markedly increased by the addition of many that are red with white underlines or with small spots on the body, or that are very dark roans easily able to pass as solid colored. It also affected the percentage of red-and-whites and whites. Witness the figures the writer is presenting (3392 red, 777 red-and-white, 3780 roan and 755 white) in this study. If normal frequencies obtained, almost any breeder not too patriotic would admit that the red and red-and-white figures should be reversed. This latter condition alone, in relation to the total number, permits forty per cent. error, so that the writer feels thirty-five per cent. is not a radical estimate.

As has been previously noted, it is usually considered that roan is heterozygous between red and white, comparable to the "blue" of the Andalusian fowl. Laughlin, however, departs from this and hypothecates, with excepted areas, two mosaically alternating sets of hairs over the body, one group possessing dominant white, the other albinic. It is the writer's purpose to consider roan a mosaic also, but to make it a simple dominant pattern consisting of an

WHY LAWS OF HEREDITY SOMETIMES FAIL.

Application of Mendel's law to the inheritance of coat color in Shorthorn cattle is much complicated by the fact that, until recently, red has been the only stylish color in this breed, and owners consequently labeled every animal "red" if it even remotely approached such a condition, thereby including many roans and red-and-whites. Diamond Goods 333014 (shown above) is recorded as red, both in the fair catalogs and herd book, although he is obviously red-and-white, which makes a good deal of difference in the transmission of color to his progeny. (Fig. 10.)

irregular arrangement of red and white hairs. It varies in amount of white within itself, hinting at the fact that it is probably not a single unit but complex. It is not necessary to go into this here as, roughly speaking, roans are readily recognized, although probably two per cent. of errors do occur. It is complicated frequently by the fact that spotting patterns appear in connection with it, thus causing the appearance of roan and white or spotted roans. These are always disregarded in recording, however, the term roan being applied to all conditions.

When a homozygous red self-colored animal (RRpp) is crossed on a homozygous white (rrPP) the offspring should be roan (RrPp). (P equals roan pattern; R equals red pigment.) On breeding these F_1 individuals, the F_2 should show nine roan, three red and four white. This is exactly what the writer has found in records from personally known animals in the Iowa state college herd, which from their breeding must be heterozygous for both factors. By breeding is meant both pedigree and breeding performance. The figures are thirty-six roan, eleven red and seventeen white. Laughlin calls attention to the fact that there is an excess of roans, 62.5 per cent., where simpler theories call for 50 per cent., and suggests three classes of homozygous roans to account for it. The writer's suggestion would call for 56¼ per cent., and the difference between that and Laughlin's 62.5 per cent. may be readily explained by the few whites recorded which thus raise the percentage of other colors.

There are figures available on roans that are apparently RRPp and RrPP. Roans of the former class bred *inter se* give ten roans and four reds, while roans of the latter class give eight roans and two whites. When the two classes are crossed, only roans, eight in number, result. This would agree with the expectation. When animals of either class are mated to the individuals of the RrPp class, the expected results appear although numbers are small, RRPp to RrPp gives three roans and one red, while RrPP to RrPp gives four roans and two whites. In these cases just preceding the term reds includes red-and-white individuals, or all except the roans and whites.

It has already been mentioned that roan and red are both complicated by spotting patterns. It may be well to digress here briefly, in order to discuss these spots. In general, it may be said that the

greatest degree of pigmentation may be found on the head and neck, over the shoulders, back, sides and hind quarters, while the lightest degree is found in the flanks, on the belly, brisket and switch and in the inguinal region. This condition may be traced in the photograph of the roan bull. If spreading of the light area takes place, the different areas of the animal yield in the following order: Flanks, withers, sides and back, rump, thighs, shoulders, neck and head. These general tendencies probably belong to a separate category from those patterns involved in the white markings on legs, face, front, or distinct body spots. That these patterns are separate is readily demonstrated by observing their segregations in red-and-white animals. With a few exceptions, these patterns are probably no more constant than the spotting pattern of laboratory mice, the variegation of maize or the checking of pigeons. Roan is entirely separate from these types of patterns, because it behaves as a distinct unit segregating away from it, although it is possible that the others may not show except in the presence of roan. However, an occasional uniform roan is found. They are usually dark roans with no tendency to the appearance of white spotting. Roan combined with the different types of red-and-whites gives as many kinds of light roan.

The advantages of assuming the red, roan, white inheritance as a di-hybrid phenomenon are manifold. It permits the production of whites from heterozygous self or spotted reds, a point which has proven a stumbling block for many students. In fact, it would permit the formation of all four classes of colors from every mating except the following: Red to red, which can produce all but roan; red to red-and-white, which can produce all but roan; red-and-white to red-and-white, which can produce all but roan, and white to white, which can produce only white.

This brings to point the discrepancies of the scheme with the table. There are a sensible number of red to reds or red-and-whites, and red-and-whites to red-and-whites that according to the pedigrees have produced roan offspring, viz.—102 out of 1851 in the subjoined table or nearly six per cent. Since in data on living or known animals the writer has never found such a condition, it was deemed advisable to investigate these 102. At present only the thirty-four presented by Robert Bruce have been investigated. Of these thirty-four, the writer was able to discover twenty-seven in-

dividuals. Submitting them to a herdsman friend who was thoroughly familiar with Cruickshank's animals, it was learned that nineteen of these twenty-seven were from red by very dark roan parents and the other eight were disputably roans or red-and-whites. The unpopularity of red-and-whites might easily cause the recording of some as roans. This investigation coupled with the confirmation of living animals makes it seem possible that these are all errors. It is extremely arbitrary to say this, but the uniform success of the first investigation makes it possible.

The other discrepancy of this theory comes in the white to white mating. Fortunately the numbers are small here, 4 reds and 8 roans being the stumbling blocks. In one instance the writer has learned that the dam of a red in question is light roan and not white. This would explain that case, while the chances of cows being served by bulls other than those named in the pedigree, the number of fraudulent entries and the sources of error already stated may account for the rest. Also the possibilities of whites of different sorts existing comparable to Emerson's beans would account for this. A white of the type of the wild park cattle of England mated to a normal Shorthorn white produced a blue gray in the cattle breeding experiments at Iowa State College. If merely red pigment were carried instead of black, the preceding colors might result.

A large number of pedigrees have been studied and the papers named at the close have been drawn upon for their records. It is undoubtedly very dogmatic to throw by the boards all evidence that does not suit, but the records of living animals and the confirmatory result of a partial investigation, make it seem possible that these speculations are founded on substantial fact.

RESULTS OF MATING.

	Red	Red & W.	Roan	White
R x R	1180	115	68	16
R x R & W	223	119	23	22
R x Roan	1431	217	1212	13
R x W	6	9	667	17
Roan x R & W	62	53	124	2
Roan x Roan	459	205	1275	471
Roan x W	3	5	168	72
R & W x R & W	21	52	11	1
R & W x W	3	2	224	1
W x W	4	0	8	141
	3392	777	3780	755

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"On the Inheritance of Coat Colour in Cattle"—1912. Laughlin—*American Naturalist*, Vol. 45 and 46.

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The Progress of Eugenics

Since the point of attack in human heredity must be largely statistical, it is of the first importance to collect more facts. Our actual knowledge is a confused mass of tradition and opinion, much of which rests upon questionable foundations. The great present need is to learn more facts; to sift the truth from error in what is already known; and to reduce all these data to workable scientific form. Much progress is being made in this direction, owing to the impetus given by the revival of Mendel's illuminating work, but as yet the science of eugenics is in its infancy.

The most systematic and effective attempt in this country to collect reliable data concerning heredity in man has been initiated by the Eugenics Section of the American Breeders Association, under the secretaryship of Dr. C. B. Davenport. In 1910 the Eugenics Record Office, with a staff of expert field and office workers and an adequate equipment of fire-proof vaults, etc., for the preservation of records, was opened at Cold Spring Harbor, Long Island, New York, with Mr. H. H. Laughlin as superintendent. "The main work of this office is investigation into the laws of inheritance of traits in human beings and their application to eugenics. It proffers its services free of charge to persons seeking advice as to the consequences of proposed marriage matings. In a word, it is devoted to the science and practice of eugenics."—Genetics, p. 246, by Herbert Eugene Walter, assistant professor of biology, Brown University. New York, the Macmillan company, 1913.

Genetics and Social Service

Any training for social service such as is now becoming frequent is of little or no use unless the principles of heredity are taught and taken into account.—W. C. D. and C. D. Whetham: Heredity and Society.

DISSEMINATION OF NEW TROPICAL PLANTS

Rich Harvest Awaits Concerted Effort Among States in Warmer Climates—New Plants to be Secured and Better Varieties of Old Ones to be Tried

C. F. Baker

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One of the most spectacular features in the agriculture of the last century was the transplantation from great distances, and sudden change from scattered and wild condition to fine and immensely valuable cultivated plantations, of Cinchona (quinine), and Hevea (Para rubber), and other important plants. Cinchona was snatched out of the wilds of Peru, and Hevea taken from the valley of the Amazon, to add to the riches of Ceylon, Java, and the Malay countries. The credit for this great work belongs to Englishmen, and in part to the Kew Gardens. Indeed, of all agencies, the English Botanic Gardens have perhaps exercised the greatest leavening influence on the tropical agriculture of the world. Such names as Willis, Fawcett, Ridley, and Wright are names to conjure with in connection with the subject of tropical agronomy. The most extensive work in the originating and disseminating of new canes, of experimentation with cacao and tea, and the introduction into English colonies of numerous valuable minor crops, are all due to the same enterprising sources. The story of these efforts and their results, read in the existing assets of today, sounds like a fairy tale, the first introductions involving hazardous long-distance sendings of a few living plants—pioneers destined to found great industries in far-away lands. The stories of discoveries of gold fields in remote corners of earth, by chance surface indications, can offer nothing more romantic or of greater moment to the world.

Very characteristic of early tropical agriculture was the extreme localization of crops. There was only one circumscribed region for good tobacco, another for spices, another for rubber, another for

SIAMESE SEEDLESS POMELO.

The pomelos (grapefruit) of Siam have been famous for many years, and repeated attempts have been made to secure them for introduction to other countries, but their inaccessibility has usually frustrated these attempts. They are now established in the Philippines, however, where they are said by experts to be fully as good as their reputation would indicate. They are probably not suited for growth in the United States, because of their tenderness. It is said that they are fond of salt water, and are usually grown where they are occasionally inundated by the sea; failing this, the cultivator places salt on the ground about their trunks. According to one report, they are seedless only in the dry season, and frequently develop seeds during the rainy months. They are generally considered, however, to be the most nearly seedless of any known pomelo. (Plate 11.)

coffee, another for cacao, whereas, as has since been so conclusively proven, there are numerous other regions equally well adapted to producing these crops. A broadcast dissemination of the more important tropical crops was one of the great agricultural features of the last century. In later years an even more interesting development has been taking place—the gradual adaptation and modification of certain tropical plants to suit greater extremes of climate, the crowding of them farther and farther into the borders of the temperate regions, close up against, or over the frost line, where greater margins of profit may often be realized from them than in their native climes.

While no other tropical cultures may ever exceed in extent those of rice, cane, corn, tobacco, coconut, coffee, tea, and cacao, it is well recognized that great numbers of as yet little-known tropical plants are gradually coming into profitable culture. Numerous important tropical products are yet harvested only from wild plants. The masses of people of the temperate regions are developing tastes, uses, and needs for numerous tropical products formerly little known and practically unexploited. The market for tropical ornamentals in temperate regions, and even in parts of the tropics, has grown enormously in the past few years. With most of these things, extreme localization is again the rule. One mountain, one valley, one island, or one limited district, may possess plants sought by the whole world. Some of the finest things long in horticulture are extraordinarily local in their original distribution. Every exploration of new or little-known regions furnishes a host of new horticultural and agricultural possibilities to the "prophetic eye." Some such regions have yielded full-fledged horticultural and agricultural prizes, equaling or even bettering some of our most highly improved economics of long standing, as, for example, fine sugar cane out of Papua, and pomelos out of South China and Siam. Novelties of great promise still appear in ever-increasing numbers. Native and practically wild fruits of far greater promise than were the progenitors of any of our temperate-region fruits, occur in great numbers throughout the tropics of the world. Magnificent ornamentals in great variety are still unknown to horticulture. What a field for exploration, investigation, and future experimentation it all presents! The gardens so common about dwellings throughout the tropics are notoriously poor in variety of ornamen-

FLOWERS OF CAMOENSIA MAXIMA.

This vine, discovered by Welwitsch in tropical Africa, has probably the largest flowers of any of the Leguminosae. Those grown in the United States (under glass) have been as long as eight inches; pure white with an edging of gold, and delightfully scented. Sometimes a dozen of these flowers are borne in a single raceme. Cultivation of this magnificent climber is at present confined to the larger botanic gardens; it first flowered under cultivation in Trinidad, in 1882. It should be widely spread throughout the tropics. (Plate 12.)

tals. One gets thoroughly tired of seeing all these little gardens planted with the same old pantropical ornamentals like *Hibiscus rosa-sinensis, Caesalpinia pulcherrima,* the Codiaeums, Dracaenas, and Aralias. One gets a very different impression when he visits a great tropical Botanic Garden—say at Singapore—and sees there grand and marvellous ornamentals, which are all the more noteworthy because not found widely distributed. Once seeing them, collectors or dealers would gladly pay almost anything within reason to obtain them. Wonderful scandent climbers are there, like *Hesea lobbiana, Bignonia magnifica, Clerodendron thomsonae* and *Camoensia maxima* (a legume with colossal flowers 9–12 inches long). It is incomprehensible why a shrub with such magnificent flowers as has *Randia stanleyana,* or a vine so incomparably beautiful as Beaumontia, should not have been more widely distributed—their culture is not difficult. Even the Philippines are rich in superb native ornamentals of the highest possible order of excellence, that are not only absolutely unknown to horticulture, but only very recently made known to science. *Paramigyna longepedunculata* is a splendid rutaceous vine, provided with masses of rich cream-colored, orange-scented flowers. *Derris philippinensis* is a vine producing a display only exceeded in beauty and richness by the wistarias of Japan. Other woody vines of extraordinary beauty of flower or foliage are furnished by the genera Symphorema, Strongylodon, and Bauhinia. Few ornamental trees are grown exceeding in beauty *Milletia foxworthyi, Wormia luzonensis,* and Petraeovitex (*fide* Dr. Foxworthy).

When one passes to the fruits it may be said that many of the finest known to the tropics have never been in anything like cultivation—some not even in a state of semi-domestication. The mangosteen and durian of the East, and the biriba and cupuassu of the Amazon, are perhaps the regal fruits of the tropics—all exceedingly local in distribution. A promising new fruit now comes from the long-settled island of Mindanao, in *Mangifera verticillata.* But these are merely examples. Resident horticulturists in many parts of the tropics tell the same story of their own regions. Some of the richest and most interesting portions of the tropics are still almost wholly untapped, so far as horticultural possibilities go. The larger Malayan islands, Central Africa, and the interior Amazonian region are rich beyond the wildest dreams of temperate region horti-

culturists. The really curious thing is, that no concerted or systematic effort is being made to exploit all these riches. Their discovery and introduction is usually due to the individual enterprise and effort of some devoted enthusiast, and so the work proceeds at a snail's pace.

The above discussion refers principally to distinct species of plants yet to be brought into horticulture. No less interesting, and of far greater immediate moment, is the matter of rare and local varieties of species long known and cultivated. Reference has been made to the finding of a new and superb sugar cane in Papua. Not many years ago but few coffees were known, whereas now many are being tried out, some of greater resistance to the destructive rust than any formerly known. Certain varieties of cacao will thrive under conditions that others will not tolerate. New forms of Cinchona are replacing those first planted. Vast numbers of distinct varieties of bananas are known in the tropics—very many of the best confined to certain remote localities. No comprehensive work on banana culture has ever been attempted, though bananas are a tropical staple, the work never having progressed beyond local collections. The same is true of upland rices, of sweet potatoes, of yams, of legumes, and many other crops.

The fruits of the tropics, as well as cacao, rubber, and other important trees and shrubs, have been propagated almost wholly from seed. This has produced a most extraordinary and interesting condition from the horticultural point of view. It out-Burbanks in richness of opportunity anything even Burbank ever dreamed of. For instance, in the Philippines, one of our common fruits, the lanson (*Lansium domesticum*), varies widely in character and value, as do also the sapodillo (chico), the santol, and other fruits. Frequently trees are found giving fruit of exceptional size, flavor, or of exceptional yield. Some are found habitually fruiting off season, and hence of exceptional value. Absolutely nothing comprehensive has ever been done to seek and isolate these better forms, propagate them, and disseminate them. The mammey of the West Indies (*Mammea americana*) is sometimes described as a fruit of only medium size, hard, and with large seeds, and the flesh resembling that of the carrot. But specimens can be found bearing fruits the size of a child's head, and when ripe, with rich, soft, and most palatable aromatic flesh, that can be readily eaten out with a spoon.

What is the use of wasting time in culture of any but these best forms? One does not really know the papaya unless one has eaten the best form of the Dapitan of Zamboanga, or some of the better varieties of Central America. One does not know the sapodilla until he has tried a variety some three inches in diameter, with melting flesh, and a minimum of gum. On hearing some aspersions cast upon the caimite (*Chrysophyllum cainito*), a valuable and delicious fruit at its best, a Cuban was heard to remark, "There are caimites, *and there are caimites!*" A similar remark might be made of most tropical fruits. The methods of seed selection, of breeding, and of vegetative propagation have rarely been brought to bear on any of these things. As for systematic search for the better forms now existing, and the rapid building up of really comprehensive experimental plantations of them in tropical Botanic Gardens and Experimental Stations, we have yet a field of highly useful, most remunerative, and intensely interesting work before us.

The tropical Botanic Gardens began collections of all the tropical fruits and economics many years ago. The first seed they obtained was often poor and unselected, representing only one strain, and often an undesirable one at that. In many instances the work has never progressed beyond that first and ineffectual attempt, and in certain instances has led to ill-founded condemnation of certain things for these localities. Yet, as before stated, the Botanic Gardens have accomplished a great work in dissemination, so far as it has gone, but they have a far greater work before them. They keep up continual exchanges of material between themselves, and with private individuals everywhere. But the development of this line of work through this channel alone, as at present operated, can only take advantage of the existing possibilities in centuries of time. There has been no such thing as systematic coöperative work in the search for and rapid dissemination of the better varieties. Yet there can be no comprehensive experimentation, no well-founded work in breeding or selection, without bringing the largest possible percentage of the very best types into experimental plantations together. Out of a large collection of roses taken to Cuba, a large number soon succumbed; a small proportion did fairly well, while a very few were great successes. Large collections of beans, peas, and other crops, taken to the tropics, commonly furnish but very small percentages of really striking and important successes. How

SAPODILLAS GROWN IN FLORIDA.

This is the fruit of *Achras sapota,* a tree found wild throughout Southern Mexico and Central America, where its milky sap is collected, evaporated, and exported as chicle, the basis for chewing gum. The tree is hardy in parts of Florida; its fruit is characterized by a thin, brown skin, inclosing a pale brown, luscious pulp in which large, black, shiny seeds are embedded. Firminger says "A more luscious, cool and agreeable fruit is not to be met with perhaps in any country in the world." If unripe, however, it is so full of gutta-percha and tannin as to be inedible. The wood, although so heavy as to sink in water, is valuable. (Plate 13.)

fundamentally important it is then, as each group is taken up for experimentation, that all possible forms obtainable from any source should be brought into the test together. As it is, we commonly find our stations trying a few from one source this year, some more from another source next year, and so on *ad infinitum,* with indefinite and scarcely comparable results, that frequently lead nowhere. The very thing that may be able to furnish an immediate success, or to furnish the best basis for breeding or selection or acclimatization work, may not come to hand for an indefinite number of years by this haphazard system.

It is not probable that one-half of the possibilities in acclimatization work have yet been sounded. Even after long reiterated opinions that strawberries, raspberries, grapes, plums, and apples could never be grown in the tropics, varieties have been found—as well as even wheat—that do fairly well under these conditions, and must eventually do very well with careful selection and breeding. The discovery of native species of Rubus, Prunus, and Vitis in warm countries greatly increases these possibilities, and fills them with horticultural interest.

Private individuals and government gardens rarely have sufficient funds available to make appreciable headway in any comprehensive effort. But surely the world is enough civilized now, and surely there is sufficient recognition of common interests among the peoples of tropical countries and colonies, for coöperative systematic work to be undertaken, that shall insure the rapid spreading of the horticultural dragnet in every tropical region of earth. The United States Department of Agriculture, with its splendidly effective foreign service, recognizes the tropical work merely as one of its subsidiary interests. Union and coöperation are demonstrated possibilities in the new International Institute of Agriculture in Rome. Tropical countries uniting and subscribing even very modestly for comprehensive field work and distribution to subscribers of abundant material in all required groups, could quickly put into operation an efficient service that would carry forward tropical horticultural and agricultural development by leaps and bounds.

ASSOCIATION MATTERS

The council has prepared a leaflet giving a brief statement of the work of the association. Members who desire to share the advantages of the organization with their friends may obtain copies of this leaflet by writing the secretary.

In response to numerous requests for information, the secretary states that he can furnish indices of volumes two and three of the magazine to any one who wishes to bind them. The index to volume one can not be furnished, as it was never printed.

The Utah Eugenics Society has elected the following officers: President, Mathohniah Thomas, Salt Lake City; first vice-president, J. C. Wheelon, Garland; second vice-president, Dr. Fred Taylor, Provo; secretary-treasurer, Dr. E. G. Titus, Logan; members of council, Mrs. Martha C. Jennings, Professor Jacob Bolin, Salt Lake City; Dr. E. G. Gowans, Ogden. THE AMERICAN BREEDERS MAGAZINE was adopted as the organ of the society.

As the magazine is the means by which the members of the American Breeders' Association are kept in touch with each other, the council will use every effort to see that each member receives the publication regularly. Members must coöperate by keeping the secretary informed of any change of address. If, after this, one fails to receive any copy of the magazine, the secretary will endeavor to supply it without delay, if notified.

In order that the association may keep in touch with the activities of its members, and may be fully informed of all progress made in its field of genetics, members who publish results of their work on this subject are urged to send copies or reprints to the office of the association, where they will be kept on file.

WASHINGTON, D. C.
1913

AMERICAN BREEDERS MAGAZINE

A JOURNAL OF GENETICS AND EUGENICS

Possibilities for a New Breed of Cattle
ROBERT K. NABOURS

The Farm, The Home of the Race
WILLET M. HAYS

A Study in Eugenic Genealogy
A. GARTLEY

Hallett's Methods and the Pure Line Theory
J. ARTHUR HARRIS

First Quarter
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